INSTITUTE OF TEXTILE TECHNOLOGY
CHARLOTTESVILLE, VIRGINIA

AMERICAN DYESTUFF REPORTER

VOLUME 46

1957

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OFFICIAL PUBLICATION OF THE PROCEEDINGS, AMERICAN ASSOCIATION OF TEXTILE CHEMISTS AND COLORISTS

American Dyestuff Reporter was founded in 1917 and the Textile Colorist and Converter (formerly Textile Colorist) was incorporated with it in January, 1949. Published every other Monday, by the **HOWES PUBLISHING COMPANY, INC.**, 44 East 23rd Street, New York 10, N. Y. **C. R. Howes**, President; **Ernest J. Finan**, Executive Vice-President; **Norman A. Johnson**, Vice-President & Treasurer; **Myron D. Reeser**, Vice-President; **C. Essenbreis**, Secretary.

Telephone SPring 7-9364

AMERICAN
DYESTUFF REPORTER
DEVOTED TO TEXTILE WET-PROCESSING

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AMERICAN
DYESTUFF REPORTER

Volume 46 January 14, 1957 Number 1

- CAMPHENE ET LE DEGRAISSEUR - THE ORIGINS OF DRYCLEANING

SIDNEY M EDELSTEIN
Dexter Chemical Corp

Dr Edelstein has documented for the first time references to some of the earliest uses of organic solvents for clothing care to be found in historical literature. In doing so, he has thrown new light on how our great modern drycleaning industry began. The drycleaner will find a new source of pride in learning of his descendency from a craft much older in time than had been supposed. The National Institute of Drycleaning commends Dr Edelstein for his fine work in this paper, and the American Dyestuff Reporter for its publication.

ALBERT E JOHNSON
Director of Trade Relations
National Institute of Drycleaning, Inc

INTRODUCTION

DIRT is many things to many people. The word conjures up a host of things both good and bad. To the farmer, it is nature's factory—the source of the world's sustenance and of his own livelihood. To the research scientist, dirt may mean a treasure box of new antibiotics for conquering disease. To the average person, however, and to those of us concerned with color and textiles, dirt is something undesirable. Its presence takes away the peasantness of our surroundings and masks the beauty of our clothes and fabrics. Cleanliness is an accepted thing today, and as a matter of course billions of dollars are spent to maintain cleanliness in our homes, in our buildings, in our clothing and on our own persons. Today no speeches need be made against dirt; and the expression, "Cleanliness is Next to Godliness," is rarely heard. This was not always so. Only a hundred years ago, a well known writer was forced to cry out (*1*):—

"Fourth-fifths of mankind live in dirt, and lose a large part of their health in consequence. What is it that robs the working classes, in many of our large towns, of nearly half their natural term of life? Dirt, dirt on the person, in the houses, in the streets, and in the air. What is it that makes the children fretful, impatient, and bad tempered? Dirt again. What is it that keeps rich people from associating with the poor, from sitting by them at meetings, or letting them come to their houses? Often, not so much pride, as dirt. What is it that destroys self respect, makes men careless and degraded, weakens the natural restraint of modesty? Dirt, again. What is it that makes the prettiest face ugly, the finest clothes tawdry, the cleverest man disagreeable, and the most splendid house uninhabitable? Dirt, again."

CHRONOLOGICAL HISTORY OF EARLY DRYCLEANING

1) First book on spot removing and cleaning, published in 1532 in Germany.
2) Spirits of turpentine used to remove tar and varnish from fabrics as early as 1690.
3) Spirits of turpentine appears in France as "drycleaner" for grease and oil stains on fabrics in 1716.
4) By 1800 spirits of turpentine is widely engaged in textile cleaning in France.
5) By 1800 spirits of turpentine is widely used as drycleaning solvent in France and Germany.
6) By 1839 spirits of turpentine widely available because of production for use in "camphine" lamps.
7) By 1850 spirits of turpentine used as immersion drycleaning solvent.
8) By 1857 benzene starts to replace spirits of turpentine in drycleaning.

As textile technicians, our interest in dirt centers mainly in those industries concerned with the cleaning of textiles. As historians, our interest might naturally be concerned with the origin of these industries. Our interest could easily center on laundering, for its beginnings go back to very ancient times and have been thoroughly studied. The origins of the drycleaning industry, however, have not been critically examined. Stories about the beginning of this industry, which does nearly two billion dollars of business per year in the United States alone, are based on hearsay, conflicting legends and inaccurate information. Certainly such an important industry deserves our spending time in looking into its antecedents. In the discussion it shall be pointed out that the drycleaning industry is not the result of some crude accident which took place in the middle of the 19th century. Rather is it the result of developing skills over a long period and a trade which received accelerations at certain times due to special economic developments.

DEFINITION ——— While drycleaning has been defined in a general way as "A cleansing of textiles in an organic solvent," perhaps the accepted definition today is the one that says (2):—

> "Drycleaning is a method of cleansing wearing apparel, household furnishings and other textile materials by means of immersion and mechanical action in dry solvents."

The removal of spots and stains which do not come out easily in the solvent treatment is also considered a part of drycleaning (3). Thus, drycleaning is eminently connected with the action of organic solvent in cleaning textiles and with supplementary methods for removing spots and stains. While unquestionably, modern techniques are reducing the importance of spotting, at one time it was pre-eminent. As we shall see, spotting antedated solvent cleaning, and the use of organic solvents for removing grease and oil stains fathered the modern drycleaning industry.

DISCUSSION

ORIGIN———To begin our story, let's take a look at the information on the origin of drycleaning furnished by various sources.

A recently published brochure on the drycleaning industry (4) says:—

> "One day a servant with clumsy hands spilled a turpentine lamp on a beautiful tablecloth. To everyone's amazement the turpentine caused a large area in the cloth to become bright in color and very clean.—This all happened less than a century ago.—Jolly Belin, a Frenchman, opened the first drycleaning plant in 1845. He used benzene, or benzol, that had been developed by some of the early and now famous chemists."

The French Federation of Dyeing and Cleaning reports (5):—

> "The first to apply the use of fuel to drycleaning was Mr John Baptist Jolly in 1825. Mr Jolly had bought a cleaning and dyeing establishment from a Mr Belin. In 1825 Mr Jolly discovered the principle of drycleaning by accident. His maid inadvertently spilled the contents of an oil lamp over a colored table cover. Mr Jolly was surprised to find after the accident that various spots had disappeared. Fuel oil, however, was not the ideal solvent, for it left greasy traces of its own; therefore tests were made with turpentine, then with benzol, derived from coal tar. It appears that in the beginning the discovery served only for removing spots, from which full cleaning by hand developed."

A well known text-book on drycleaning says (6):—

> "Shortly after the isolation of benzene, a Frenchman, Jolly Belin, discovered that it would remove grease stains from fabric, after which the dirt that had been held by the grease could be liberated. This was the beginning of the drycleaning industry."

Now, obviously, all of these accounts cannot be right for they are indeed contradictory. At least, however, we can accept the implications that by the middle of the last century there were people engaged in "drycleaning." For anything more definite we must depend on our own researches.

DRYCLEANING IN THE MID-NINETEENTH CENTURY———As a starting point for these historical researches, let us really take a look at drycleaning in the middle of the 19th century. Now, our source of information must be authentic writings of the period. We cannot depend on hearsay, for apparently hearsay has been the cause of so many contradictory statements already being widely circulated as to the origins of the drycleaning industry.

I should like to refer to a large volume entitled, "The Art of Dyeing, Cleaning, Scouring and Finishing, on the Most Approved English and French Methods," by Thomas Love (Second American Edition, Philadelphia, 1869.) The first and second editions were published in 1854 and the American edition is really a reprint of the second English edition of 1854. Since it certainly would have taken Love several years to accumulate his information, we have before us a true picture of the state of the drycleaning art in Europe about 1850. Love says (7):—

> "French cleaning, as it is called, has no more to do with the French nation, than it has to do with the English, but everything must have a name. It would not do to call it Scotch or Irish cleaning. No! No! That would not go down with the fashionable classes, so when we want to clean in camphene we tell our customers this work must be cleaned the French way, just to please them, and they think it must be good because it has a French name. English and Watson's camphene is considered the best for drycleaning on silks. The French know no more of cleaning in camphene than the English, and the reason is simply this: camphene as it comes from the makers must have nothing added to it; if you put water, spirit, or soap in it, or any alkali, it is spoiled. It cleans all sorts of silk fabrics, when not very dirty, in such a manner that nobody would ever think they had been wetted; to clean them properly, they must be passed through one, two, or even three separate liquors of it. It neither changes or alters color, but it takes the dirt, oil, and grease out of silks, cotton, and wool, assisted by labor, and the work must not be rinsed or spirited after it has been through a liquor of it; after that it must be sheeted up dry directly, but it will not clean work that is too much worn or soiled, that must be taken apart and cleaned, in what is called the English way, and a very good way it is, for it takes all the grease and dirt out of it effectually, and improves both silk and color when done with judgement and care." (Here Love refers to the age-old method of cleaning by washing with soap and water).[1]

The equipment and materials needed a century ago for drycleaning are described by Love (7):—

> "A scouring board for French cleaning ought to be six feet long, three feet wide, one inch thick, and made of American pine without splits or knots, and very smooth and strong; one side of it to be covered with green or drab cloth, fastened by tin tacks to the edges and ends of the board, and made as tight and as smooth as a billiard table. The other side is to have no covering on it; this way it will answer two purposes in French cleaning, as will presently be seen. With this board three brushes will be wanted to work the camphene, which brushes can be bought at Mr Lilly's, brushmaker, Wakefield Street, Regent Square, Bloomsberry, London, he makes all the brushes used for dyers, scourers, and French cleaners, where they are always ready; other brushmakers do not understand our want in brushes so well as he

[1] Spirits of turpentine has been called, at various times, oil of turpentine, spirits of terebenthine, camphene, camphine and turps.

does, for he makes it his study and has the trade. They are not unlike the white hair brush with taper ends, used in dusting and brushing coach linings. There must also be a sponge, clean flannels, also clean India cloths. When all these things are ready, the French cleaning may be commenced and continued with a certainty of success. King, Seymour street, Euston Square, and Legg, Wardour street, Soho, sell English and Watson's camphene, and almost all oil shops and drysalters in London and the principal towns in the country sell it. When the camphene has cleaned the work, and is too dirty to be used again, it is taken back to the shop it was bought at and exchanged for clean. The camphene is sold in sealed tin boxes or cans, in quarts, half-gallons, and gallons. These tins must be paid for or returned."

A final picture of the drycleaner's need for skill and the great care with which he treated a garment a century ago is obvious in Love's instructions on cleaning a whole silk or satin dress (7):—

"The safest way to dry-clean a silk or satin dress of any color is, to take the body off the skirt, and clean each part separately. If the dress is a valuable one, take off the sleeves also. When they are clean, remake them, all the French workmen do it, why not the English, let us follow a good example no matter where it comes from.

"Have two clean earthen vessels that will hold two gallons each, and put half a gallon of camphene in each; have a smooth board, six feet long and three feet wide, suitable brushes, and four or five clean sheets. Be very particular about the sheets being dry and clean. Your sheeting board is not to be encumbered with all your sheets on it, have only one on it. Some people make a dreadful mess of their work with the best intention, from their slovenly habits, such people must bear in mind the song of Darby Kelly—

'That in his wrist he had the twist.'

"Begin by cleaning the body first. Put the body in the first liquor of camphene, then lift it onto the board, brush the inside well, and then the outside. When this has been done, put it back in the first liquor of camphene, then in the second, and let it drain over the second a minute; spread a sheet on the board, lay the dress on it, and directly begin and rub it dry with the clean Indian cotton cloths. While rubbing it, keep it smooth and shape it, so as that, when dry and cleaned, it will look as if it had not been wetted. Take the sleeves next. Clean them in the same manner as the body. The skirt comes next, one after another, and it is to be cleaned exactly in the same manner as the body and the sleeves by passing it through the two camphene liquors, brushing and sheeting it up dry before leaving it. Dispatch is the life and soul of this work, as the camphene is of such a drying nature that it requires great expedition in the cleaning. When the dress is done, it must be hung up for some hours in an airy room. The smell of the camphene will come off in a few hours in a very hot stove room. The best method is to clean the camphene work in the afternoon and hang it by the stove all night to take the smell off. Any silk or satin dress can be cleaned whole by this method, but it is safer to take the skirt off the body, which most cleaners do that intend not to be beat."

Now at this point we have determined with certainty that in the middle of the last century there was a highly organized system of drycleaning using spirits of turpentine as the solvent. But we still know nothing about the origins of this industry. There are certain threads, however, which we can follow, or should follow, back into the past, in order to determine where and how drycleaning started.

THREADS INTO THE PAST——— First, we must consider the drycleaning solvent itself. From Love's work we find that, in the middle of the last century, spirits of turpentine was the solvent being widely used. While benzene had been discovered in 1825 by Faraday, it did not become an article of widespread commerce until several years after 1850. The development of solvents from petroleum and particularly gasoline occurred at even a later date. Hence, if we are to look into the history of drycleaning solvents, then we must choose spirits of turpentine as our main interest.

As another thread into the past, we must take a look at spot removing or cleaning itself. Many books of recipes and secrets written through the centuries have devoted space to the subject of cleaning and spot removing. In fact, even many centuries ago the subject was of enough interest to cause the publication of special books. As time went on, rather large treatises were devoted wholly to the subject of cleaning and spot removing.

To follow our two threads backward, we must therefore trace the story of spirits of turpentine and its uses through many books on pharmacy, chemistry and technology which have been published through the ages. Simultaneously, we must examine the books of secrets, formulas, recipes, home economics, cleaning, scouring and spot removing that have also appeared in great profusion through the centuries, for references to the use of spirits of turpentine or other organic solvents for cleaning or spot removing.

It is never possible to make certain that every available book, pamphlet or item concerned with the subject has been examined. All that one can do is to examine a number of the well-known books and some of the more obscure things published at many different periods with the hope of finding a connected and reasonably accurate story.

Probably the oldest printed book on spot removing and dyeing is a little 12-page volume printed in Mayence, Germany, in the year 1532. A literal translation of the German title says (8):—

"To remove all kinds of stains and specks from clothes, velvet, silk, gold wear, dresses, whether these spots are from fat, oil, or wine or the like; and to effect this removal in an easy way without damage, with water or lye. Moreover, also how to restore the dyeing of a fabric that is faded and also how to dye yarn and linen fabrics as well as wool and bone material in various shades." (See Figure 1).

Our particular interest in this little volume rests with its formula for removing grease or oil stains from fabrics, for the very beginnings of drycleaning must lie in the use of an organic solvent for the removal of such stains. Unhappily, none of these formulas are based on the use of organic solvents in any remote way whatsoever. One formula for removing grease or oil out of white cloth says:—

"Take whaie of milke sodden with floure, steepe your clothe in it so farre as to the spotte the space of a night, then wash with faire river water, and hang in the sunne."

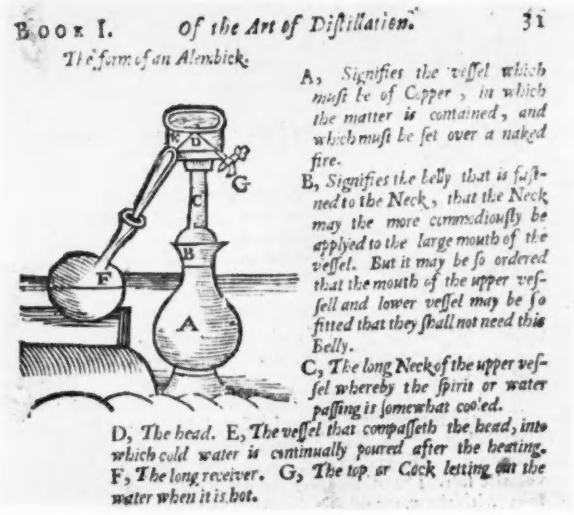
Another formula for removing grease and oil says:—

Allerley Mackel vnd
Flecken auß Gewant/Sammath/Seyden/Güldinen
ſtucken/Kleydern ꝛc. zů bringen/Es ſeyen Schmaltz
flecken/ôl odder weyn flecken/odder wie die mögen
genennt werden/Vnd das alles leychtlich on
ſchaden/mit waſſern odder laugen/wie
es dann inn diſſem Büchleyn gelert
wirt/zů volbringen.

¶ Dazů auch wie eynem yecklichen Gewant ſeyn ver-
lorne farb widder zůbringen ſey/Deßgleychen wie
man garn vñ leynwat/auch holtz vnd beyn/
mancherley farben/ferben ſal.

¶ Getruckt zů Meintz bey Peter Jordan im
Mertzen des M. D. FFFII. Jars.

Figure 1
Title page of earliest known printed book on spot removing and dyeing (Mayence, 1532).



BOOK I. *Of the Art of Diſtillation.* 31

The form of an Alembick.

A, *Signifies the veſſel which muſt be of Copper, in which the matter is contained, and which muſt be ſet over a naked fire.*

B, *Signifies the belly that is faſtned to the Neck, that the Neck may the more commodiouſly be applyed to the large mouth of the veſſel. But it may be ſo ordered that the mouth of the upper veſſell and lower veſſel may be ſo fitted that they ſhall not need this Belly.*

C, *The long Neck of the upper veſſel whereby the ſpirit or water paſſing is ſomewhat cooled.*

D, *The head.* E, *The veſſel that compaſſeth the head, into which cold water is continually poured after the heating.* F, *The long receiver.* G, *The top or Cock letting out the water when it is hot.*

Figure 2
Apparatus for preparing spirits of turpentine in 1653 (from French's "The Art of Distillation")

"Take water that peas have been soaked in and steep your cloth where the spot is in it and then wash with clean river water."

Another and probably more efficient formula says:—

"Take cold lye with cream of tartar and water and wash your cloth in it."

Since this particular little book was reprinted in its entirety for almost a century in the popular and famous "Secrets of Alexis" as well as in other books of secrets, one must assume that it was the authority on spot removing in the first half of the 16th century (*9*). Therefore we must assume that the use of an organic solvent for removing spots was not generally known, if at all, before 1532.

Now, to another famous but rare book of the period dealing with the preparation of medicinal waters and balsams. This book is entitled, "The Treasure of Euonymus," and was published in London in 1559. This volume contains the technical lore on distillation and the preparation of medicinal waters of the famous Gesner. The "Treasure" devotes two pages to "oyle of turpentine" and describes several methods for its preparation by distillation of the turpentine itself (*10*). On its use Gesner says:—

"Some commend oyl of turpentyn for the grief of the stone."

And also:—

"To put awai skars, or rather to asswage and mollifie them, oyl of turpentin doth chiefli profit, except those that remain after warts. For they that commend this oyl for the putting awaye the markes of wartes, they are deceived."

As to the solvent powers of oil of turpentine, Gesner is silent.

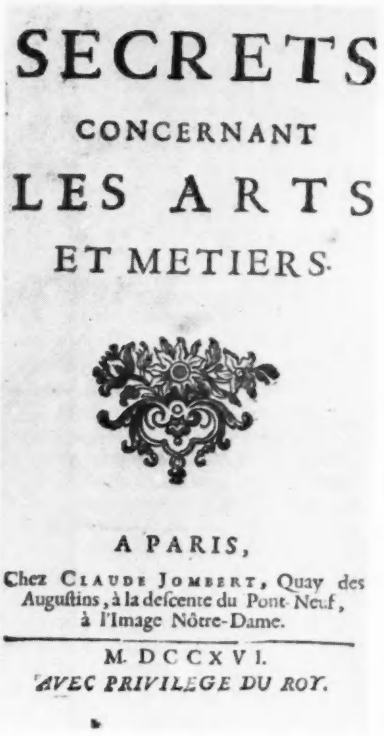
By the middle of the 17th century oil or spirits of turpentine had become a well-known article for use in medicine, and perhaps its solvent properties were beginning to be recognized. These solvent properties, however, were in connection with the preparation of gum or resin solutions for use in painting or varnishing. The technique of preparing spirits of turpentine in those early days is clearly given in John French's famous work on the art of distillation. According to French, oil or spirit of turpentine is made thus (*11*):—

"Take of Venice turpentine, as much as you please, of spring water four times as much, let them be put into an alembick, or copper still with its refrigeratory, then put fire under it; so there will distil a thin white oil like water, and in the bottom of the vessel will remain a hard gum called Colophonia, which is called boiled Turpentine: that white oil may be better and freer from the smell of the fire if it be drawn in Balneo, with a gourd, and glass head." (See Figure 2).

In 1692 Y-Worth, the successor to the famous John French, also describes the preparation of oil of turpentine in his "Chimicus Rationalis" but Y-Worth also does not know the solvent properties of spirits of turpentine and does not even mention its medicinal uses.

William Salmon, the famous writer on medicine and pharmacy, who wrote in the last quarter of the 17th century, apparently considered turpentine and its derivatives of great importance. In one work he devotes a whole chapter to the subject of turpentine (*13*). Speaking of spirits of turpentine he says:—

"The aethereal and subtil oil commonly (but improperly) called spirit of turpentine, for that it is fat, unctuous and inflammable; and is nothing else but the volatile and mercurial salt of turpentine, acid and sharp, and a dissolvent of tartarous substances. This spirit deserves esteem for its balsamick astriction which never hurts or prejudices, the nervous and membranous parts as all other sharp and acid spirits do. It lenifies and sweetens by its balsamick quality and through the help of its detersive salt, mundifies strongly and cleanses the viscosities, impurities and other ill dispositions of the lungs, womb, ureters and spermatick vessels, when any hurt happens in those parts or any unclean matter lies lurking in their sinuosities or secret infoldings, which cannot be either removed or corrected by the help of many other remedies. . . ."



SECRETS

CONCERNANT

LES ARTS

ET METIERS.

A PARIS,

Chez CLAUDE JOMBERT, Quay des Auguſtins, à la deſcente du Pont-Neuf, à l'Image Nôtre-Dame.

M. DCCXVI.

AVEC PRIVILEGE DU ROY.

Figure 3
Title page of "earliest book", showing use of drycleaning solvent (1716)

Does this description mean that Salmon realized or understood the solvent properties of spirit of turpentine and adopted this in the explanation of its medical uses?

For another viewpoint, at the same period, we examine a little volume entitled, "Art's Treasury of Rarities and Curious Inventions," devoted mainly to dyeing, spot removing, drawing and painting. In the section devoted to spot removing we look at the recipes for removing grease or oil from soiled fabrics (*14*). None, however, mention solvents or spirits of turpentine. The anonymous writer is still depending on the use of soap or alkalies with water. As we turn the pages we are rewarded however. Under the heading—"To take pitch, tar, rosin or beeswax out of any stuff, silk or cloth," we read:—

> "Take oil of turpentine, warm it a little and apply it to the place, suffering it to soak in for the space of an hour; and then gently rub it, and you will perceive the rosin, etc, loosened and instantly to crumble away."

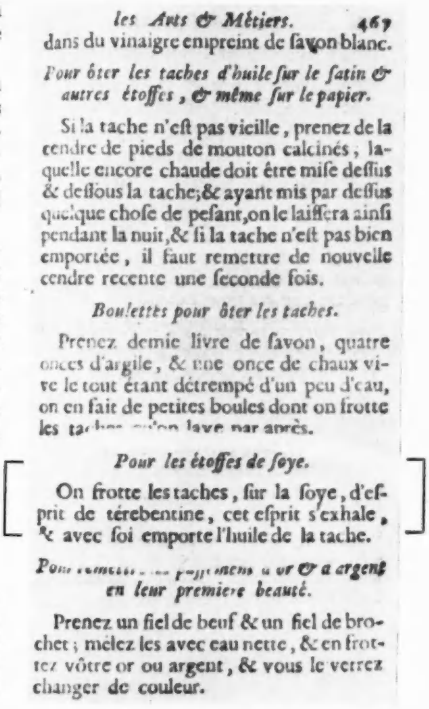
Here is the first recognition of the use of an organic solvent for cleaning textiles that we have found. One would expect it to be just a short step from softening rosin or beeswax with oil of turpentine to removing grease and oil spots with oil of turpentine.

Our short step takes us to France in the year 1716, to the rare but famous book of secrets entitled, "Secrets Concernant les Arts et Metier," and particularly to chapter XVI, devoted to "The Secrets of Removing Spots and Stains" (*15*).

At first our examination of the formulas for removing stains containing fats and oils shows the typical recipes which had been in use for hundreds of years—the use of soap or egg yolk or oxgall with water as the solvent. As we continue, however, we are rewarded, for under a "Special secret for removing grease and oil spots from silk stuff," we read:—

> "One rubs the spots on the silk with spirits of turpentine, this spirit evaporates and takes with it the oil in the spot."

Here in France in the year 1716, in a book which contains the accepted trade secrets of the time, is a clear recognition of the solvent properties of spirits of turpentine and its recommendation as a drycleaner for silks. Thus, *there is no question but that the very beginnings of drycleaning go back at least to 1716.* (See Figures 3 and 4).



les Arts & Métiers. 467

dans du vinaigre empreint de ſavon blanc.

Pour ôter les taches d'huile ſur le ſatin & autres étoffes, & même ſur le papier.

Si la tache n'eſt pas vieille, prenez de la cendre de pieds de mouton calcinés, laquelle encore chaude doit être miſe deſſus & deſſous la tache; & ayant mis par deſſus quelque choſe de peſant, on le laiſſera ainſi pendant la nuit, & ſi la tache n'eſt pas bien emportée, il faut remettre de nouvelle cendre recente une ſeconde fois.

Boulettes pour ôter les taches.

Prenez demie livre de ſavon, quatre onces d'argile, & une once de chaux vive le tout étant détrempé d'un peu d'eau, on en fait de petites boules dont on frotte les taches, puis on lave par après.

Pour les étoffes de ſoye.

On frotte les taches, ſur la ſoye, d'eſprit de térebentine, cet eſprit s'exhale, & avec ſoi emporte l'huile de la tache.

Pour remettre les paſſements d'or & d'argent en leur premiere beauté.

Prenez un fiel de beuf & un fiel de brochet; mêlez les avec eau nette, & en frottez vôtre or ou argent, & vous le verrez changer de couleur.

Figure 4
The "earliest" solvent drycleaning formula (1716)

Now the fact that the use of spirits of turpentine as a drycleaning solvent was published in a very popular book in 1716 does not mean that this information became immediately known throughout Europe. A little laundry book containing recipes for stain removal, published in Leipzig about

Commodes

Und beſtändig währendes

Waſch-Büchlein,

Darinnen

Alles Wäſch-Geräthe

Derer Mannes- und Weibes-Perſonen,

und zur Haußhaltung gehöriges, vom Gröſten biß zum Kleineſten enthalten, daß man alle Stücke, ohne vieles Schreiben, in geſchwinder Kürtze, genau bemercken, und wieder auslöſchen kan;

Sondern auch

Ein Kern fürtreflicher Künſte/

Wie nemlich

Die Wäſche von allerhand Eiſen-Dinten-Fett- und andern Flecken zu reinigen; güldene, ſilberne Spitzen, Treſſen, Franzen, auch weiſſer und ſchwarzer, glatter und krauſer Flor zu waſchen. Flecken von Wagenſchmier, Wachs, Oel, Wein, Dinte ꝛc. aus Sammet, Seiden, wöllen und leinen Kleidern, zu bringen; Kleider und Pelzwerck für Motten zu bewahren; Kleider und Wäſche wohlriechend zu machen; Perlen Edelgeſteine, Gold- und Silber-Geſchmuck wieder auszuputzen und auf das ſchönſte zumachen.

LEIPZIG,

Zu finden, bey Johann Chriſtoph Hartmann, Buchbinder.

Figure 5
Frontispiece and title page of early laundry book (Leipzig, 1730)

1730, reveals no mention of the use of spirits of turpentine for removing oil or grease stains (*16*). Perhaps the fact that this book is concerned mainly with laundering in the home could mean that there was no need for any special solvent methods for removing the oil and grease stains. (See Figure 5).

Getting back to our main investigation, one would expect that the chemical books of each period would contain even more detailed information about specific substances than would the books of the craftsmen or books of secrets. Certainly, one would expect that the important and well-known chemical books of the 18th century, when discussing spirits of turpentine, would understand and point out its solvent properties. Peculiarly enough, this is not so. The famous "Cours de Chymie" of Lemery published in Paris in 1757 discusses the manufacture of spirits of turpentine and describes many of its uses in medicine, but there is nothing concerning its solvent power (*17*). "The Chemical Works of Caspar Neuman," published in English in 1773, devotes several pages to spirits of turpentine but no mention is made of its powers as a cleaner or as a solvent (*18*). Even Macquer's famous dictionary of chemistry, published in France in the third quarter of the 18th century, makes no mention of the solvent powers of spirits of turpentine, and only mentions its medical uses (*19*). This is particularly surprising since Macquer was the famous authority on silk dyeing and was intimately concerned with various aspects of textiles.

Even though the great chemists of the 18th century were not giving spirits of turpentine its due as a drycleaning solvent, the European housewife was not missing a bet. Witness the following paragraph from "Der Oeconomische Frauenzimmer" published at Leipzig in 1773 (*20*):—

> "How from velvet, half silk, and file clothes the dirt, oil and other similar foul spots to clean off.
>
> "One takes spirits of turpentine and puts a drop on a piece of clean linen cloth and rubs the stain with it lightly; after this one takes another clean cloth and wipes the spot. Then the fabric is allowed to dry over a stove and if the stain is not gone, this is repeated."

That such information was of particular importance to polite society is indicated by the literal translation of the title page of this work, to wit:—

> "The polite lady skilled in economy—showing for an experienced person the most profitable and proper things, which for the decoration and beauty of people as well as for the male and also the female sex may be necessary." (See Figure 6).

Figure 6
Frontispiece and title page of "Frauenzimmer" (Leipzig, 1773)

By 1806 the "drycleaning" properties of spirits of turpentine were known not only to the housewife but were even being explained to children. Witness the discussion between Mrs Bryan and Caroline in Jane Marcet's famous " Conversations on Chemistry." On page 312 of the first American edition (*21*), the two girls, Caroline and Emily, are discussing the volatile and essential oils and particularly spirits of turpentine. Caroline says:—

> "Such waters (meaning spirits of turpentine) are frequently used to take spots of grease out of cloth or silk; how do they produce that effect?"

Mrs Bryan replies:—

> "By combining with the substance that forms these stains; for volatile oils dissolve wax, tallow, spermaceti and resins; if therefore the spot proceeds from any of these substances it will remove it."

Thus by the beginning of the 19th century spirits of turpentine was widely known as a drycleaning solvent for spot removal and widely used. But was cleaning and spot removing a business or was this something practiced just by the housewife?

That the profession of cleaner (degraisseur)[2] or dyer-cleaner (teinturier-degraisseur), was important in France, at least in those days, is proven by the publication in 1808, in Paris, by the great French chemist, Chaptal, of a book entitled, "Chemical Principles Concerning the Art of the Dyer-Cleaner." (See Figure 7). In the forward to this book (22), Chaptal says:—

> "I know that the profession of cleaner doesn't occupy a very eminent place among the arts and crafts but I also know that there is scarcely any other in which the operations are so essentially founded on a knowledge of chemistry.—Also, one doesn't deny that the profession of cleaner is not of as great interest to society as that of the dyer which decorates the fabrics which are used for our clothes with brilliant and fast colors. Nevertheless, the cleaner who rehabilitates these changed colors doesn't deserve any less consideration.
>
> "One has seen a series of chemists of the greatest standing, such

[2]Homassel writing in 1799 says:—"The name degraisseur for cleaner came about because most of the stains which he removes are at least part grease or fat." (*23*).

as Leonardi, Scopoli, Struve, Giobert and others occupying themselves with the art of cleaning. I believe that according to their example I can treat this material and I am determined with considerable reason to write these chemical principles on a familiar art and I have a new occasion to prove how chemistry can be applied with advantage to uses which are important to society."

Chaptal's book is a complete and scientific system of spot removing. Spots and stains are divided into basic types, and reagents for removing these basic types are given. A system for treating compound stains is also discussed. Finally, the part of the dyer is described, and methods for restoring colors which have been changed by chemical action are given. Final methods involve actual spot dyeing of the portions where the color has actually been destroyed and cannot be recovered.

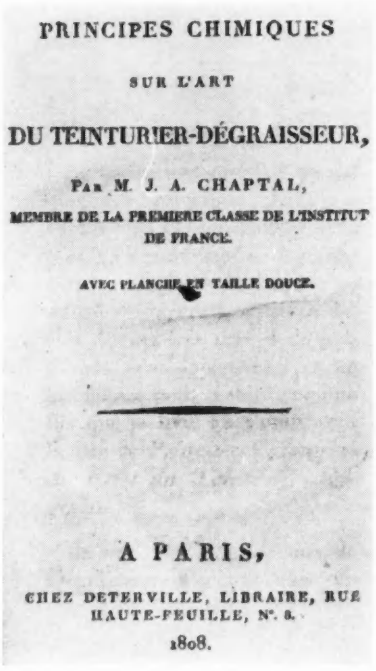
Under methods for removing grease and oil, Chaptal in great detail discusses the use of alkali, soap, absorbent earths, oxgall and egg yolks—all of which had been used for centuries. Chaptal also points out how certain materials such as absorbent earths or oxgall may be mixed with sulfuric ether but he points out that sulfuric ether is really too volatile and too expensive to use.

Chaptal advises that the substance most generally used to remove oily stains is "L'huile Volatile au essence de terebenthine"—spirits of turpentine. Chaptal says that:—

> "This oil dissolves all the fatty bodies, all the resins, and does not alter in general the colors or the fibers. Its odor can be masked with other volatile oils."

From this there is no question but that the established cleaning profession in France at the beginning of the 19th century regularly used spirits of turpentine as a drycleaning solvent for removing spots and stains containing grease, oil or wax.

Up to this point, in all applications using spirits of turpentine as a drycleaning solvent, the spirits have been applied to the fabric. In none of the writings so far examined has the fabric been immersed completely in the spirits of turpentine. By 1850, however, we find a well-established industry doing drycleaning by a method essentially as we know it today—that is by immersing the fabric in an organic solvent. Just when and how did this change over take place? An examination of LeNormands practical treatise on cleaning published in 1819


PRINCIPES CHIMIQUES

SUR L'ART

DU TEINTURIER-DÉGRAISSEUR,

PAR M. J. A. CHAPTAL,

MEMBRE DE LA PREMIERE CLASSE DE L'INSTITUT DE FRANCE.

AVEC PLANCHE EN TAILLE DOUCE.

A PARIS,

CHEZ DETERVILLE, LIBRAIRE, RUE HAUTE-FEUILLE, N°. 8.

1808.

Figure 7
Title page of Chaptal's famous work on spot removing and cleaning

in Paris (*24*) further closes in on the time of the change over. LeNormand shows that in all cases, and for all fabrics, the whole operation of cleaning as done by the degraisseur of the year 1819 is essentially a spot or stain removing operation. In no case is the whole garment immersed completely in water or in a solvent.

We are finally confronted with darkness concerning the final step whereby the spot removing drycleaning operation of 1819 became the full immersion drycleaning of 1850. Perhaps we shall never know absolutely the exact moment or the exact place where the change over was made. So far, no books or documents which can be considered authentic can give us an unquestionable answer.

Then again perhaps there were gradual changes made by many persons over an extended period. There are, however, certain economic facts available which can help us piece together a reasonable story even if it is based partly on conjecture.

The key to our puzzle is spirits of turpentine, for this material was the only drycleaning solvent readily available. Perhaps in the history of the economic developments of the use of spirits of turpentine for purposes other than for cleaning lies the key to the secret for which we hunt.

For ages the source of light in homes and factories had been either candles or lamps burning whale oil, lard oil or other oils. Increasing needs for better illuminants called forth inventive responses, and in the 1830's a synthetic illuminant superior to whale oil appeared in spirits of turpentine (25). In Ure's, "A Dictionary of Arts, Manufactures and Mines," first published in 1839, in London (*26*), under the heading 'Lamps,' there is this:—

> "The leading novelty under this title is the construction of lamps for burning spirits of turpentine in the place of the fat oils which alone have been in use from the remote ages down to the present time. Several patents have recently been obtained for these lamps under the fantastic title, camphine.
>
> "Among the many applications of science to the useful arts, for which the present age is so honorably distinguished, few are more meritorious than the camphine lamp, by which we can provide a snow white flame from the cleanly colorless spirits of turpentine—a pure combustible fluid, in place of the smeary rank oils."

For a period from approximately 1830 to approximately 1850, the manufacture and use of spirits of turpentine as an illuminant increased enormously. A large production of the material was available from the United States and spirits of turpentine became a common article of commerce instead of the expensive drug that it had been for several centuries.

We know that at the time of the great increase in the availability of spirits of turpentine, that is, around 1830, the cleaners of France and other countries, as well as the housewives, were regularly using spirits of turpentine for removing fatty and oily stains from fabrics. Is it not likely that many cleaners now having this solvent available in quantity, and at a cheap price, would at about the same time begin to clean the soiled fabrics sent to them by the easier and more satisfactory method of dipping in the solvent rather than by applying the solvent directly only to the stains? Is it not more likely that a great industry like the drycleaning industry is the result of the normal development of a specialized cleaning industry, which had been in existence for hundreds of years, rather than the chance discovery of a housemaid? Certainly economic forces have often been responsible for more changes than chance discovery.

We have now completed our circle. We are now back to the 1850's where a definite drycleaning industry along modern lines is in operation. We cannot, however, fail to continue a bit past the time of the 1850's to see what

Figure 8
Itinerant "spotter" (Paris, circa 1850)

has happened to our old friend, spirits of turpentine.

There is no question but what spirits of turpentine suffered from a number of disadvantages as a drycleaning solvent. It readily lost its solvent power unless freshly distilled. Secondly, its use left a definite odor in the goods which was difficult to remove.

In 1825 benzene was discovered by Faraday in the liquid compressed out of illuminating gas. This product remained essentially a laboratory curiosity for many years, although in 1834 Mitscherlich had shown how it could be produced by the reaction of benzoic acid and lime. The possibility of benzene as a real commercial chemical was realized in 1845 when it was discovered in coal tar by Hofman. The first successful commercial method for preparing benzene from coal tar, however, did not appear until 1849 (27). Thus, benzene did not become available commercially until after the time when spirits of turpentine was being widely used for immersion drycleaning. While benzene, as a drycleaning solvent, had many advantages over spirits of turpentine, it was not used, and could not have been used, as the first solvent for true immersion drycleaning. Spirits of turpentine had become a cheap commercial item when benzene was still an expensive laboratory chemical.

By 1856, however, with the discovery of synthetic mauve by Perkin and with the need for large quantities of benzene for the preparation of the dyestuff, this better drycleaning solvent became widely available and apparently quickly replaced spirits of turpentine (*28*). By 1857, W A Miller, writing in his "Elements of Chemistry" (27), had this to say under the subject of benzene:—

> "Its solvent power for fats and oils enables it to be used with advantage for removing grease stains from articles of silk or woolen. When benzene is required in considerable quantity its cheapest source is coal naptha."

At the same time the drycleaning use of oil of turpentine was being quickly forgotten, for Miller under "Oil of Turpentine" says:—

> "It is largely used in the preparation of varnish."

No mention is made of its cleaning or medicinal properties.

CONCLUSION

In looking back over our round trip into the past with the drycleaning industry, we are pleased that we have revealed a much clearer path, and have shown that the principle of drycleaning was known as early as the year 1716, and in common use many years before the beginning of the 19th century. We have also shown that this important industry has a background in crafstmanship which reaches back through the centuries. Especially interesting has been the interconnection between the chemist, the pharmacist, the apothecary, the dyer, the cleaner —and the lamp maker. Spirits of turpentine was first used for medicine and then later for cleaning. The first producers of spirits of turpentine were the pharmacists or druggists who first furnished this solvent to the cleaner. The druggist gave way to the seller of lamp fuels as the supplier of the drycleaning solvent. The dyestuff industry itself, in producing a chemical (benzene) required to make its new brilliant dyestuffs, furnished a new drycleaning solvent, which in turn was needed to restore the brilliancy of these new synthetic dyestuffs dyed on fabrics. Finally, the continued search for improved lamp fuels brought forth kerosene and its by-product, gasoline, which in turn became the common drycleaning solvent.

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RECENT ADVANCES IN THE FIELD OF ACID AND SUBSTANTIVE ANTHRAQUINONE DYESTUFFS

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This summary of the field of anthraquinone dyestuffs is considered to be the first of its kind since the handbook by Houben, which was written immediately after the first World War. The author primarily emphasizes new developments, made since 1925. Chemical structures of the modern dyes are shown, and the author briefly discusses the lines of development followed in order to meet desired standards of shade, fastness to milling, and level dyeing.

This paper was prepared by Dr Gunthard for delivery at the International Wool Conference in Zurich. Later in 1956, he read it before the "Maison de la Chimie", in Paris.

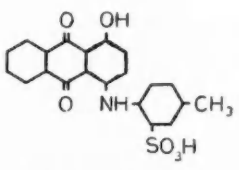
HISTORY AND CLASSIFICATION OF THE ANTHRAQUINONE DYESTUFFS

I SHALL merely repeat a well-known fact in saying that the discovery of mauveine by Perkin in 1856 formed the starting point for the manufacture of synthetic dyestuffs. Industrialists were quick to recognize the technical and commercial significance of this field of chemistry, and a period of intense research preceded the establishment of the constitution of madder or alizarin by Graebe and Liebermann in 1868 and its synthesis by the same workers in 1869. Anthraquinone thus made its entry into the large family of synthetic dyestuffs.

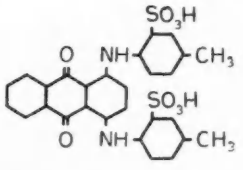
The first anthraquinone dyestuffs were hydroxyanthraquinones fixable on wool and cotton by means of mordants; they were followed by sulphonated hydroxyanthraquinones also fixable with aluminum and chrome mordants. In 1894, R E Schmidt of Bayer discovered the first acid anthraquinone dyestuffs. The acid dyestuffs were in fact known at this date, though only in the azo series, and with this range alone it was not possible to dye textiles in the range of shades extending from violet to green. The disclosure of this new approach was of course a discovery of the first importance which gave rise to widespread and varied research. Parallel developments were the synthesizing of benzanthrone by Bally in 1904 and of indanthrene blue by René Bohn, his chief of research in 1901.

This brief historical resumé enables us to distinguish the three classes of anthraquinone dyestuffs, namely the mordant, acid, and vat colors, existing around 1925, the year which marks the end of what may be called the classical anthraquinone period. Since that date the disperse dyestuffs and

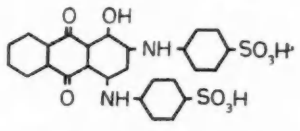
TABLE I
Classical Dyestuffs



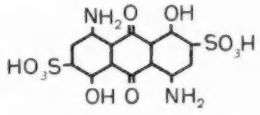
Alizarine Irisol R
(Schmidt 1894)



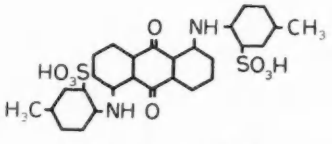
Alizarine Cyanine Green G
(Schmidt 1894)



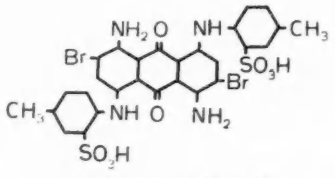
Alizarine Blue Black B
(Schmidt 1894)



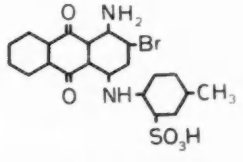
Alizarine Saphirol B
(Schmidt 1897)



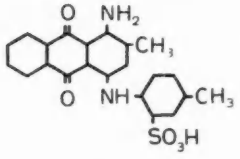
Anthraquinone Violet
(Bally 1898)



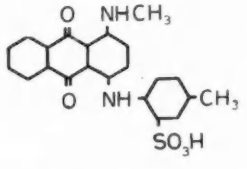
Anthraquinone Blue SR
(Bally 1898)



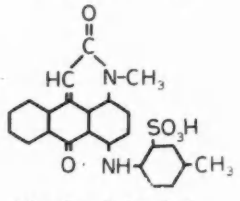
Alizarine Sky Blue B
(Unger 1899)



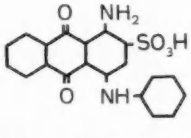
Cyananthrol R
(Isler 1900)



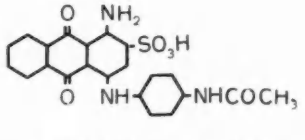
Alizarine Astrol B
(Schmidt 1901)



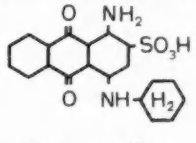
Alizarine Rubinol R
(Tomaschewski 1906)



Alizarine Direct Blue A
(Herzberg 1913 & Agfa 1925)



Alizarine Direct Blue A2G
(Agfa 1925)



Alizarine Brilliant
Sky Blue R
(Weinand 1925)

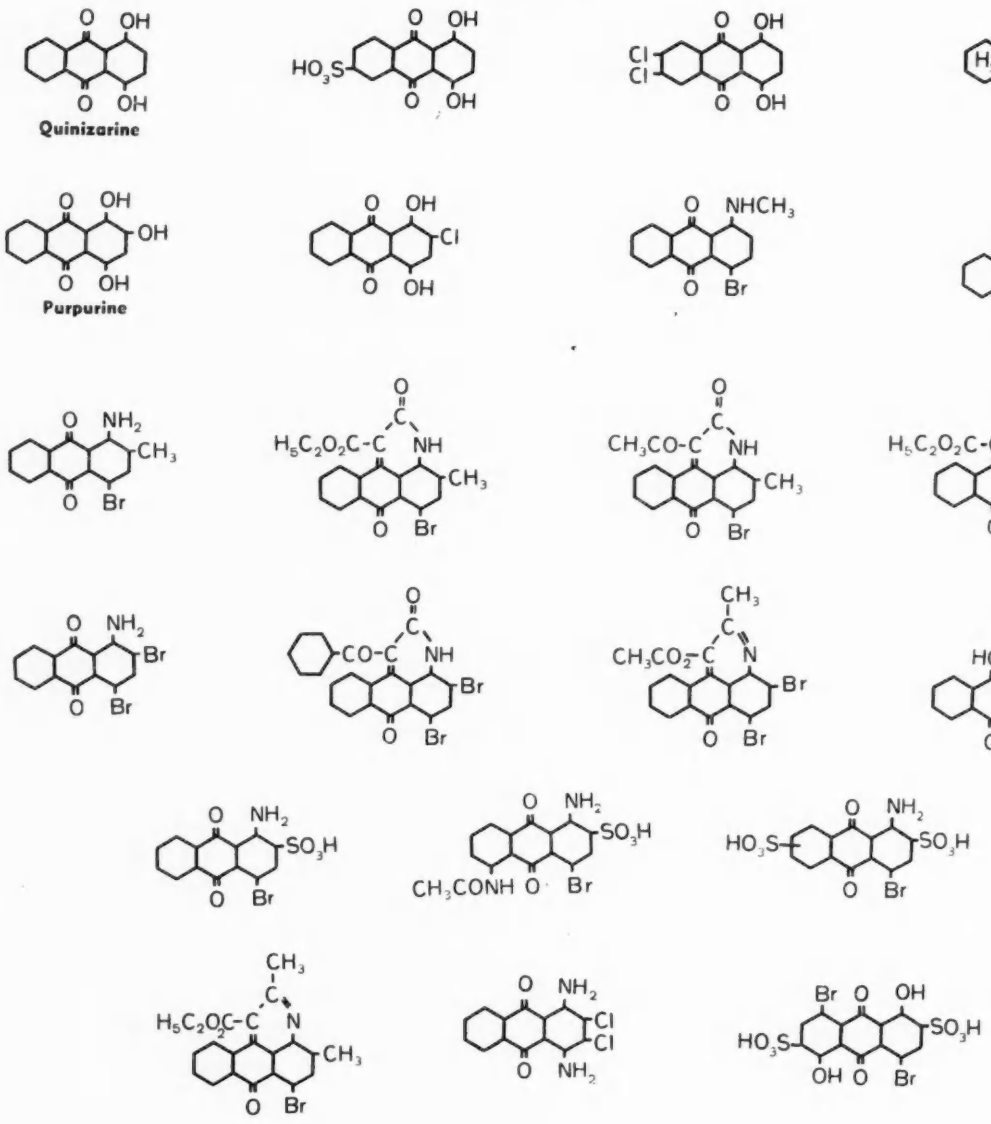
the pigment colors developed for application to man-made cellulosic fibers (viscose rayon, cellulose acetate) and the synthetic polyacrylonitrile (Orlon) and polyester (Dacron, Terylene) fibers have been added. This class, which we may discuss on some future occasion, is destined for considerable development.

INTRODUCTION TO ACID ANTHRAQUINONE DYESTUFFS

This present paper will be confined to the additions to the class of acid and substantive anthraquinone dyestuffs since this classical period, additions due to research undertaken partly by my company and partly by other dyestuff manufacturers. It may be noted in passing that it was at about this time that the firm of Sandoz decided to include acid anthraquinone dyestuffs in its production program.

In Table I are enumerated the principal dyestuffs which were commercially available thirty years ago. You will note that all or almost all of them exhibit a disubstitution 1.4 by hydroxyl or amino groups. The pairs of free electrons in the nitrogen and oxygen permit entry into resonance with the carbonyl groups in meso-position of the anthraquinone. Moreover, the 1.4 disubstitution causes a shift to the long wave side of the spectrum. and consequently these dyestuffs are both the most intense and the deepest in shade. A tinctorial comparison of Alizarine Cyanine Green G with anthraquinone violet affords the most conclusive proof of the influence of the 1.4 position of the auxochrome groups. These dyestuffs are not identical in all their properties nor are they remarkable for their fastness, but they have provided chemists with a foundation on which to construct molecules for the dual purpose of studying their dyeing properties and meeting the practical requirements of application to wool and cotton.

TABLE II
Starting Products



PRESENT POSITION OF THE ACID ANTHRAQUINONE DYESTUFFS

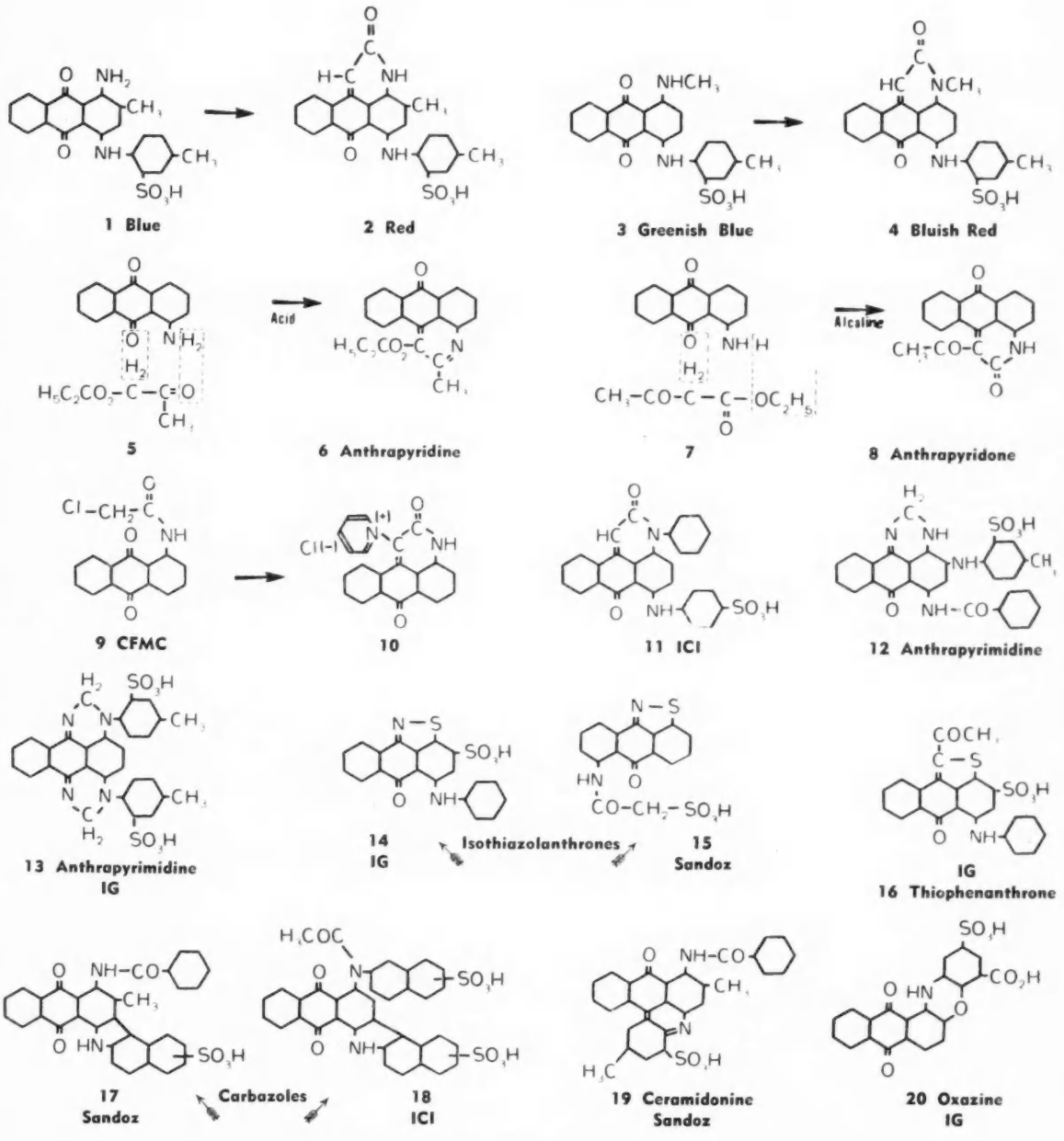
The requirements of bulk application which govern the direction of applied research may be summarized as a) shade, b) fastness to milling, and c) level dyeing; the high fastness to light which anthraquinone confers on the molecules of the dyes in which it is included may be assumed to be an intrinsic property. Reference to the relevant literature reveals two lines of development from the constitutions of Table I:

1) modification of the basic scheme of the anthraquinone, and
2) variation of the type of substituents, notably the amine radicals.

The anthraquinone starting products from which the currently available dyestuffs are produced will be found in Table II. Their syntheses are so classical that there is no need for me to discuss them further.

A) SHADE——The problem of shade would be simple if, in a group of dyes with definite properties, it was sufficient to have three elements—a yellow, a red and a blue—to obtain all the shades desired. This is realizable only with products of the very best

TABLE III
Color Modification of the Base Scheme



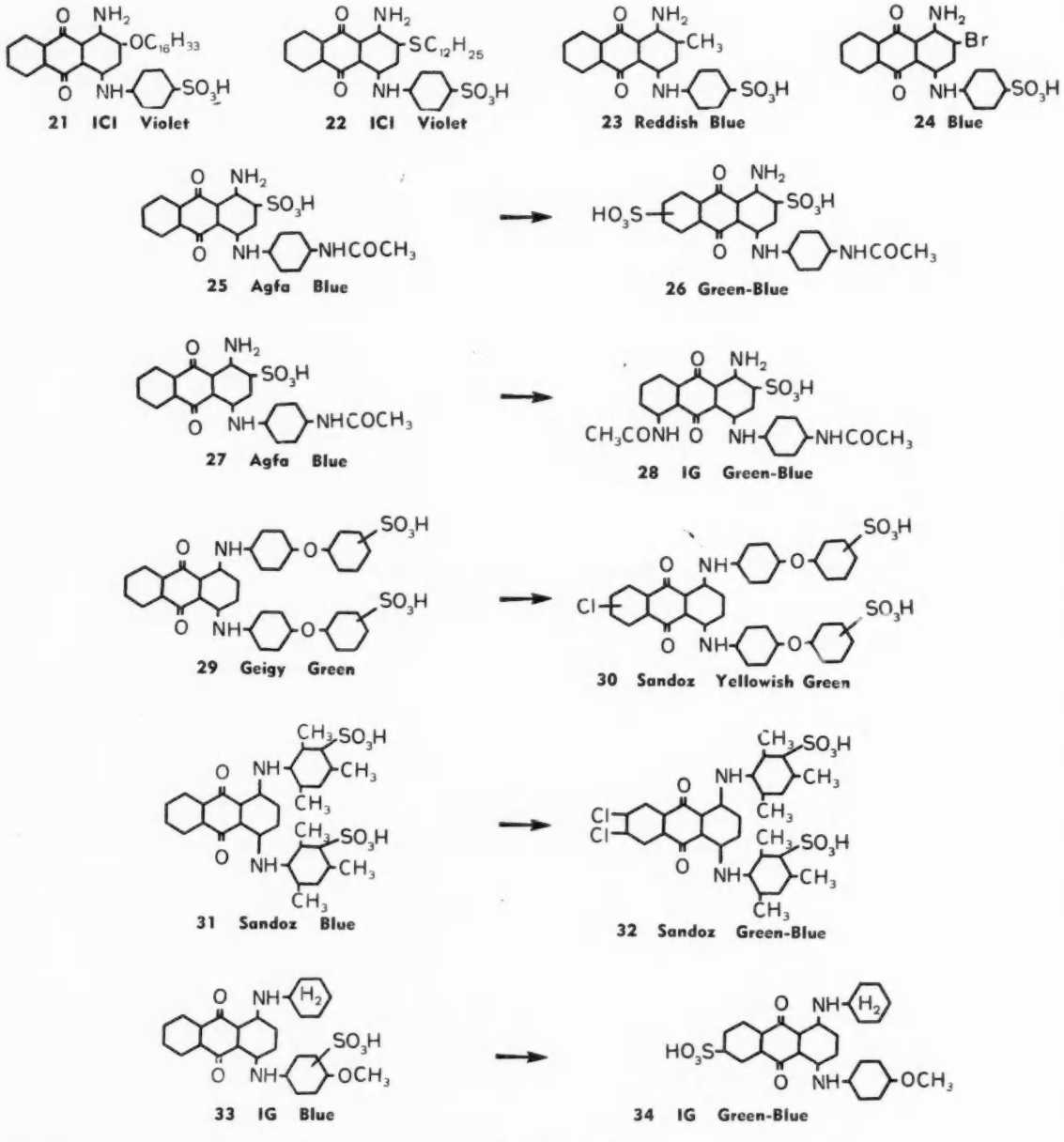
leveling properties; the other classes have to be composed of members which provide a gradual and complete range of shades. We shall see how the acid anthraquinone dyestuffs enable us to achieve this.

1) *Ring Closure from α-amino groups.* The closure of a pyridone ring has a hypsochromic effect on a basic scheme, provided the latter contains an amino group in the 1 position of the anthraquinone (Table III, formulas 1, 2, 3 and 4). Condensation to give pyridone is effected by means of acetic acid, or preferably with the esters of acetylacetic, malonic, benzoylacetic, or even cyanoacetic acid. The shade changes from blue to red.

We found recently that the acetylacetic esters are capable of reacting in two different ways according to whether the catalyst is of an alkaline or acid nature (formulas 5, 6, 7 and 8). The pyridine dyestuffs are yellower than the pyridones. The Compagnie Française des Matières Colorantes has found that the chloracetyl derivatives can be ring-closed to yield pyridone; the reaction is conducted in presence of pyridine with intermediate formation of a pyridinium salt which is split by reduction (9 and 10). It is also possible to ring-close the 1-arylaminoanthraquinones to give pyridones (11), and to obtain yellow anthrapyrimidines (12) and anthradipyrimidines (13), and isothiazolanthrones (14-15) and thiophenanthrones (16) which are also yellow to brown in shade.

TABLE IV

Color Modification of the Substituents in the Anthraquinone Nucleus



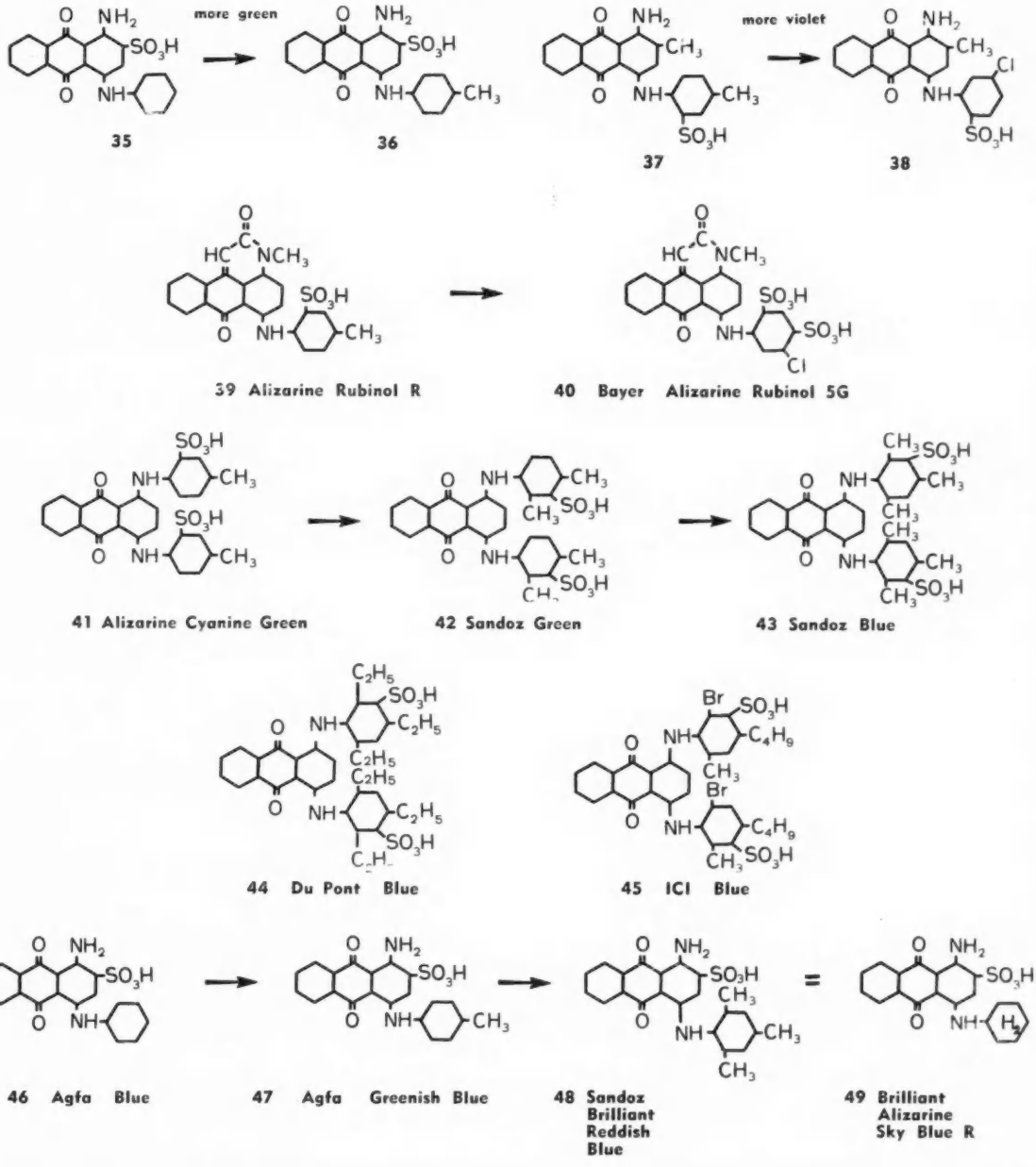
2) *Ring Closure from α-arylamino groups.* Certain 1-arylamino groups permit of modifications to basic skeleton of a different nature; ring closure by acid agents leads to carbazoles (17 and 18) or ceramidonines (19), the shade changing from the initial violet to yellow-brown or orange-brown. Finally we may mention the violet to blue-violet oxazines of the I G Farbenindustrie (20).

3) *Influence of the Substituents in the Anthraquinone Nucleus.* Table IV illustrates the variations of shade obtained by modifying the substituents in the anthraquinonyl radical. Thus, greater depth is attained by replacing an oxyalkyl in the position with a thioalkyl, an alkyl and a halogen (21, 22, 23 and 24), and also by each substitution of the benzene nucleus of the anthraquinone molecule previously free from substituents (25, 26-27, 28-29, 30-31, 32-33, and 34).

4) *Influence of the Substituents in the Arylamino Nucleus.* The final variation in shade from a definite constitution which we will consider is that produced by substitution of the arylamine nuclei. This opens up a number of possibilities which are briefly indicated in Table V. The results depend on the induction and mesomeric effects of the atoms or groups of atoms em-

TABLE V

Color Modification of the Substituents in the Arylamine Nucleus



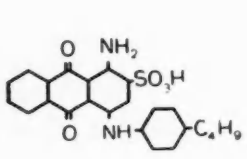
ployed as substituents. In other words the variation of shade is a function of the modification, by substitution, of the polarity of the system; this modification is due to the tendency shown by certain atoms or groups of atoms to attract the electrons of the system or contrariwise to place electrons at its disposal. Thus a methyl in the para-position turns the shade greener (35 and 36), while a chlorine in the meta-position reddens it (37 and 38, 39 and 40).

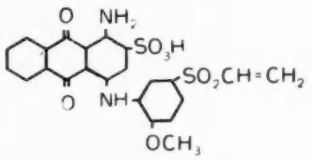
To conclude this discussion of shade we will take a particularly interesting example, 1.4-dimesidinoanthraquinone and its homologues. Alizarine Cyanine Green G is greener than 1.4-dianilinoanthraquinone. The introduction of a second methyl group in the arylamine residue does not modify the color appreciably, but a third $-CH_3$ group causes the shade to revert to blue (formulas 41, 42, 43 and 44). If the third substituent is a halogen, the result is identical and the color still redder (45). The explanation of this is very simple: we are confronted with a phenomenon of steric hindrance by ortho-ortho disubstitution of the phenyl nucleus. The arylamine nucleus is no longer in the plane of the anthraquinone nucleus and can no longer participate in the mesomerism of the molecular arrangement. Its effect is now comparable to that of an alkylamine or a cyclohexylamine. The series of formulas from 46 to 49 is a repetition of this phenomenon from 1-amino-2-sulpho-4-anilinoanthraquinone; the last two dyestuffs are very similar in shade.

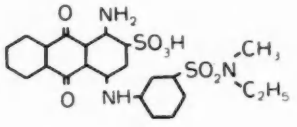
By modification of the basic scheme it is thus possible to enlarge the classical range of blue and violet acid anthraquinone dyestuffs to include reds, oranges and even yellows. In addition, variations in the position and nature of the substituents permit minor variations of shade, for example from green to yellowish green and from blue to blue-violet. All requirements would be satisfied if there did not remain the problem of the milling and levelling dyestuffs.

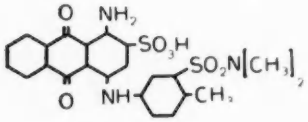
B) MILLING——Fastness to milling is an essential property for wool dyestuffs. For this purpose hydrophobic groups are introduced into a given molecular structure by "charging" the dye molecules. In effect, milling is a form of washing in alkaline medium at fairly high temperature, and any substitution or modification of structure which decreases

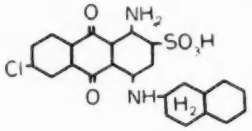
TABLE VI
Milling Dyestuffs I

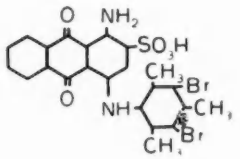

50 ICI

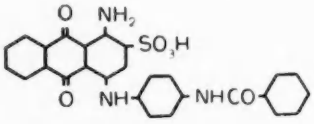

51 Hoechst

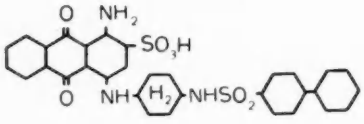

52 IG

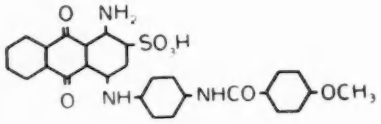

53 Sandoz


54 Sandoz


55 Sandoz


x 56 Sandoz


57 Bayer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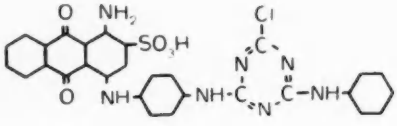
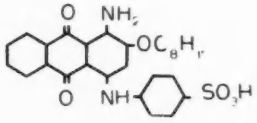
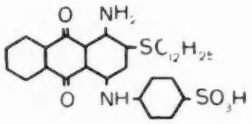
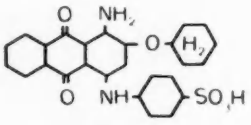
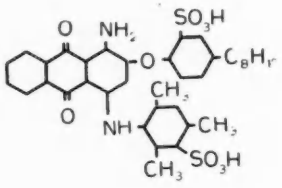

59 Ciba


60 ICI


61 ICI


62 IG


63 Sandoz

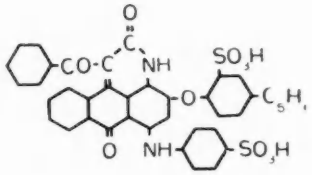
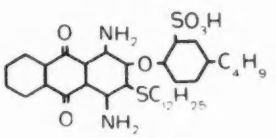
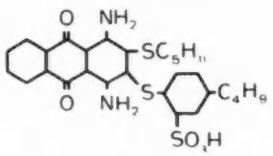

64 Sandoz

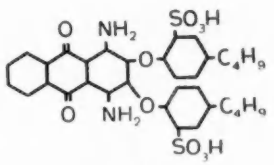
TABLE VII
Milling Dyestuffs II



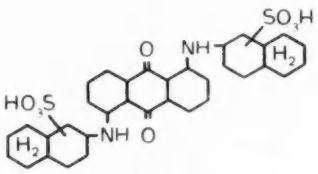
65 ICI



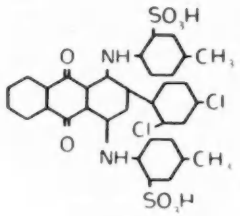
66 ICI



67 ICI



68 IG



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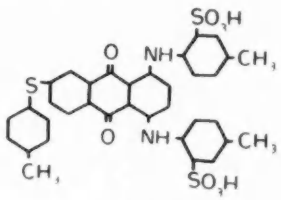
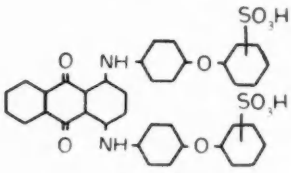
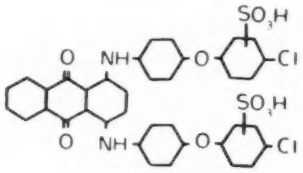


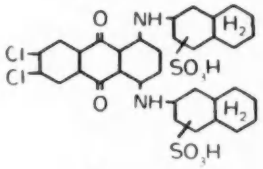
70 IG



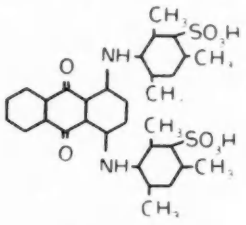
71 Geigy



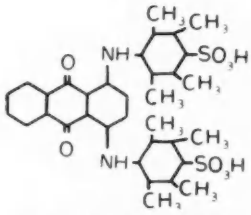
72 Sandoz



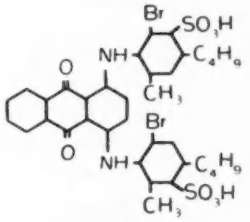
73 Sandoz



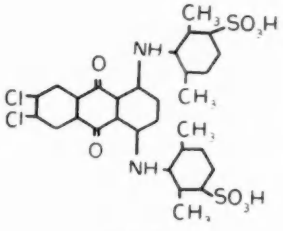
74 Sandoz



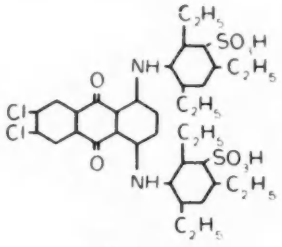
75 Allied Chemical



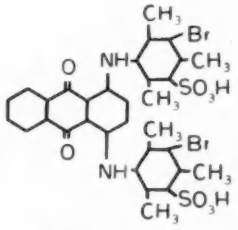
76 ICI



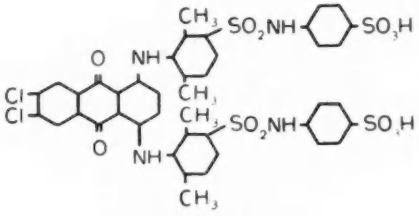
77 Sandoz



78 Sandoz



79 Sandoz



80 Sandoz

the affinity of the dyestuff for water contributes to its fastness to milling.

Alkyls, cycloalkyls, aryls, halogens and sulphones are among the most commonly used substituents belonging to the group of hydrophobic radicals in question. The molecules lose their water solubility with increasing weight, but regain it on the introduction of a second, truly "hydrophilic" sulphonic acid group, whose action, however, does not become apparent if the molecule is already fairly "heavy."

It will be of interest here to review the successive proposals which have marked the progress made in the fastness properties of these dyestuffs from the more or less moderate fastness to washing of the examples in Table I to the milling colors of the present day.

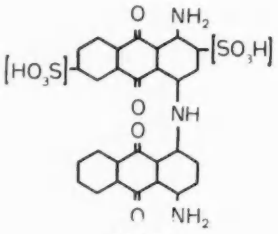
1) 1-amino-2-sulpho-4-anilinoanthraquinone, the famous Saphirol A, has been substituted by alkyls containing a large number of carbon atoms (Table VI, formula 50), vinylsulphones (51), sulphamides (52 and 53), the best procedure being to combine two hydrophobic actions, eg, alkylation and halogenation (54 and 55).

2) 1-amino-2-sulpho-4-p-acetaminoanilinoanthraquinone has not sufficient fastness to milling. It can be improved by substituting the alkylacyl group by an arylacyl group (56), which may itself be substituted, or better still by acylating the aminoaniline nucleus, after prior hexahydrogenation, with the diphenyl sulphonyl radical (58). Proceeding on analogous lines, Ciba has patented dyestuff No. 59, where acylation is effected by the action of cyanuric chloride. This dyestuff is essentially an intermediate of the substantive anthraquinone dyestuffs, as we shall see in due course.

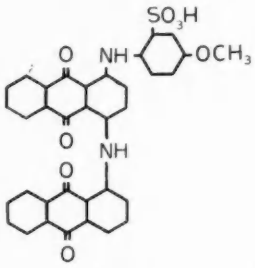
3) The violet dyestuffs derived from 1-amino-2-methoxy-4-anilinoanthraquinone acquire satisfactory fastness to milling when the substituent in the 2 position is replaced by an aliphatic chain having a large number of carbon atoms or by a cycloaliphatic chain (formulas 60, 61 and 62). We have recently found that the best result is obtained with an aryl substituent, itself

TABLE VIII

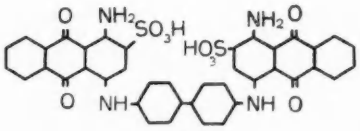
Milling Dyestuffs III



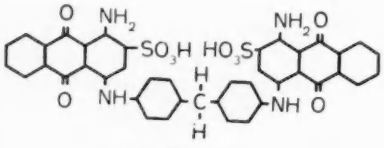
81 IG



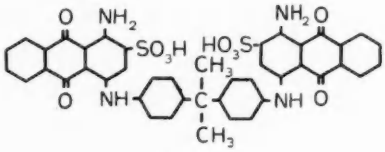
82 IG



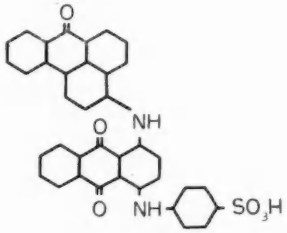
83 Sandoz



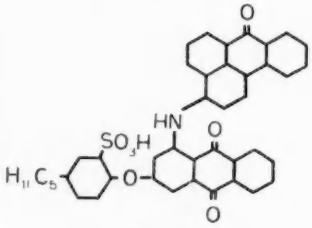
84 Sandoz



85 IG



86 Sandoz



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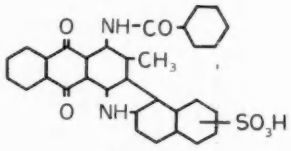

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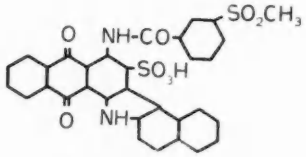
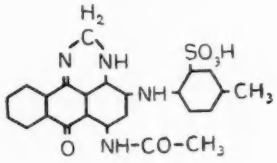


89 Allied Chemical



90 IG

substituted by a long aliphatic chain (63), and in pursuance of this idea we have prepared a red anthrapyridone (64), which is particularly fast to milling.

4) The formulas 65, 66 and 67 of Table VII illustrate three proposals of ICI for obtaining violet milling dyestuffs from anthralan violets.

5) The fastness to milling of anthraquinone violet is augmented when the p-toluidine is substituted by tetrahydro-β-naphthylamine (formula 68).

6) Alizarine Cyanine Green G has been modified, first by additions to the anthraquinone nucleus (69 and 70) and second by substitution of the arylamine (71 and 72). Here also the best course is to combine the action of the halogens and the alkyls as shown in formula 73.

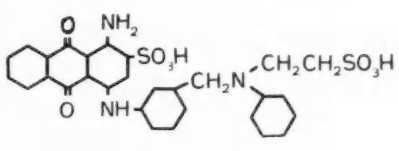
7) Finally, in the series of the blue 1.4-diarylaminoanthraquinone derivatives which exhibit an ortho-ortho disubstitution of the imine group in the arylamine, the fastness to milling of the first dyestuffs (74 and 75), although already good, has been further improved by a) a long alkyl chain (76), b) halogenation of the anthraquinonyl radical (77 and 78) or the arylamine (79), and c) by combining the action of the halogens with substitution by an arylsulphonamide (80).

So far we have only considered the action of hydrophobic substituents on a basic skeleton for the purpose of improving the fastness to milling. Certain other modifications of this scheme also lead to interesting results:

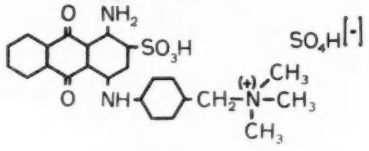
a) Coupling of two anthraquinone molecules to give grey dianthrimides (Table VIII, formulas 81 and 82).
b) Coupling of two molecules of 1-amino-2-sulpho -4- anilinoanthraquinone by an oxidizing agent (83), formaldehyde (84) or acetone (85) to yield blue to bluegreen dyestuffs.
c) Coupling of a benzanthrone molecule and an anthraquinone molecule to give greys (86) or browns (87).
d) Ring closure to form carbazoles (88 and 89) and anthrapyrimidine (90).

These are the types of dyes which have been evolved by chemists for

TABLE IX
Leveling Dyestuffs I



91 Cassella



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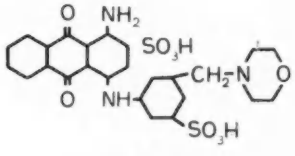

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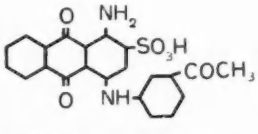
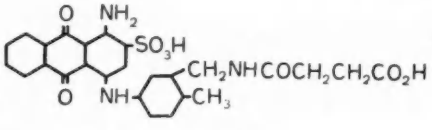
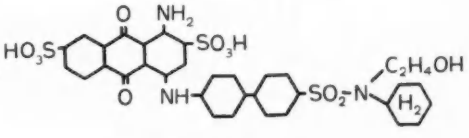


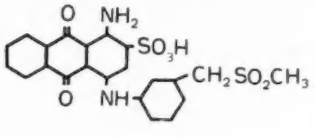
94 Deutsche Hydrierwerke



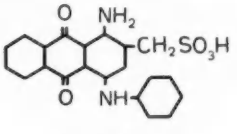
95 GAF



96 Allied Chemicals



97 IG



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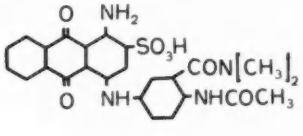

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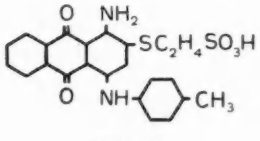

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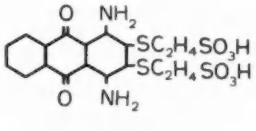
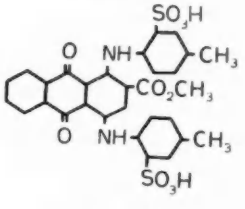
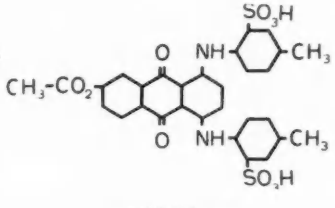


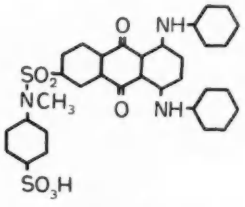
101 IG



102 IG



103 IG



104 IG

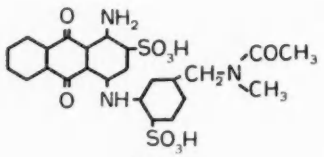
employment as milling colors, by which we mean dyestuffs having a fastness to milling of 4 to 5 or 5. At the beginning of this section on milling we saw that this property was a function of the reduction of the affinity of the molecules for water. Dyes of this type are probably fixed on wool by ionic or covalent chemical linkages as well as by adsorption and Van Der Waals forces. In consequence they build up rapidly and the production of level shades is a delicate task of a purely technical nature; slow elevation of temperature, thorough agitation of the material, and rapid circulation of the liquor are among the contributory factors.

C) LEVEL DYEING——Level dyeing is a property specific to the dyestuff which enables it to supply all the available sites with an equal concentration of color. When this property is lacking the dyeings are said to be skittery or unlevel. Two methods of level dyeing have been established to date. The first is applied with dyestuffs having affinity in a strongly acid medium; by progressively increasing the acidity of the bath, the shade is built up slowly and evenly. The second technique is made possible by the neutral and weakly acid dyeing colors which enter into solution in a strongly acid medium and are then re-absorbed on the fiber. They migrate from the heavily dyed areas of the substrate to the lighter colored sites.

Chemically there is no universal rule for the construction of good lev-

TABLE X

Leveling Dyestuffs II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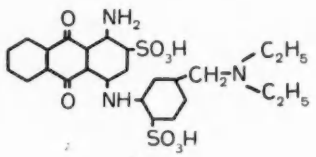
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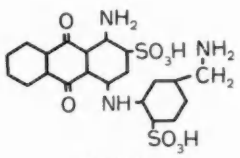
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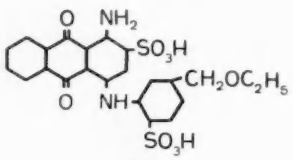
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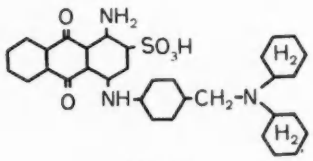
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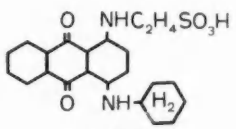
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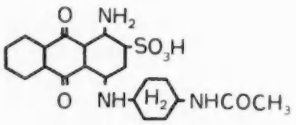
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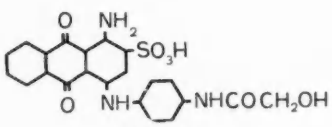
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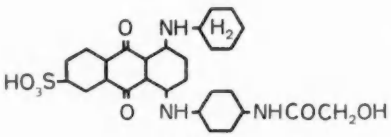
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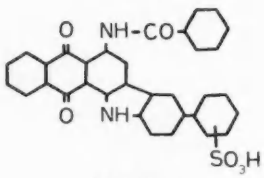
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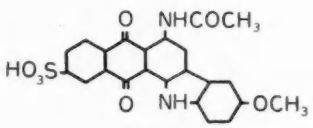
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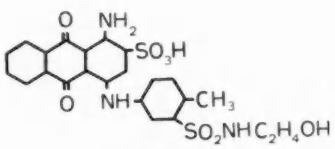
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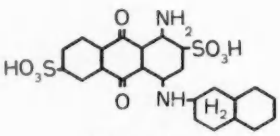
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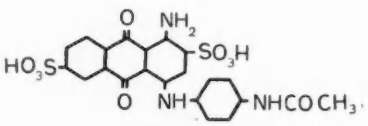
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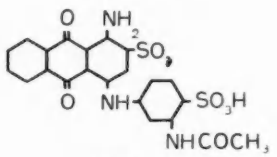
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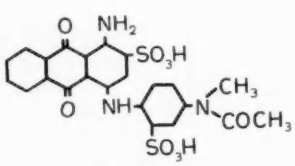
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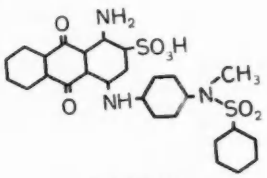
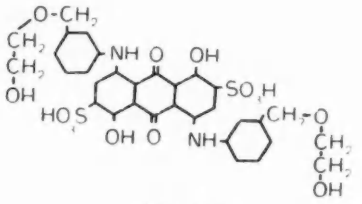
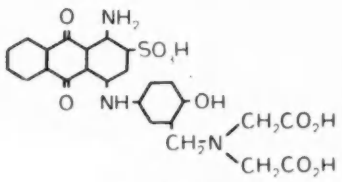

121 Sandoz

TABLE XI
Topchrome Dyestuffs



122 GAF



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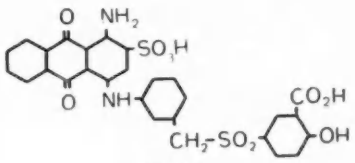

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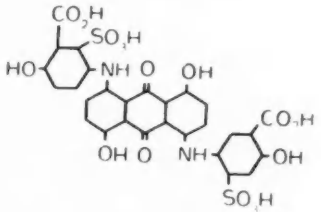

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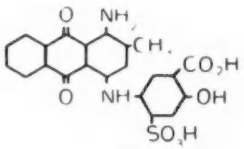

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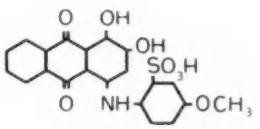
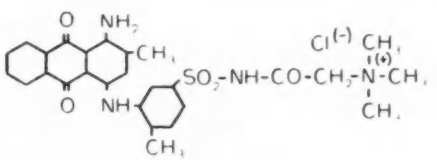
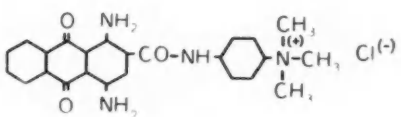


127 IG

TABLE XII
Dyestuffs without Sulphonic Acid Groups



128 Deutsche Hydrierwerke



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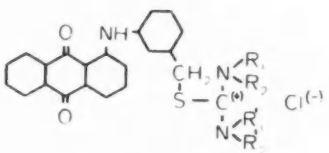

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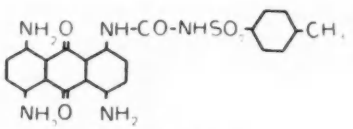
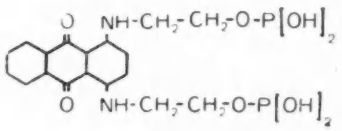
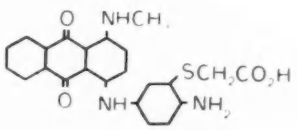


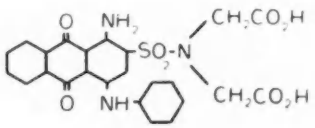
131 BASF



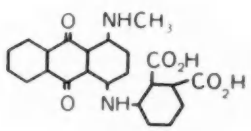
132 IG



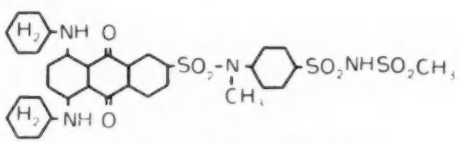
133 ICI



134 IG

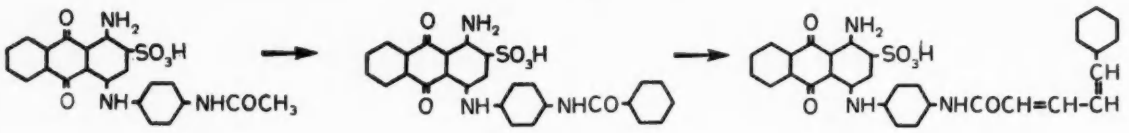


135 ICI

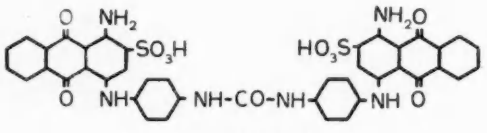


136 Deutsche Hydrierwerke

TABLE XIII
Substantive Dyestuffs



137 Agfa — 138 Sandoz — 139 IG



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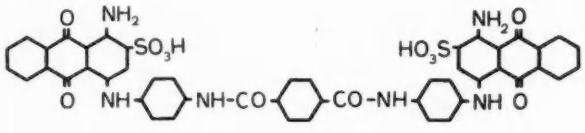

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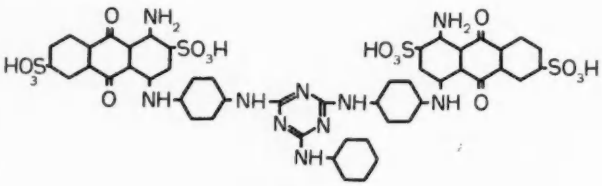

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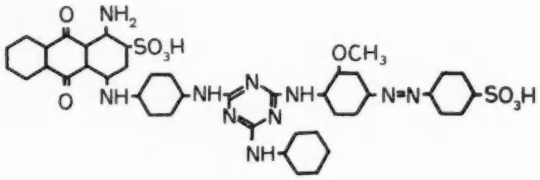

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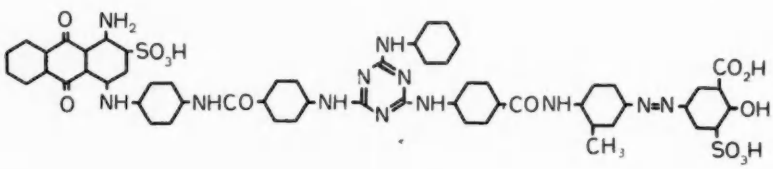

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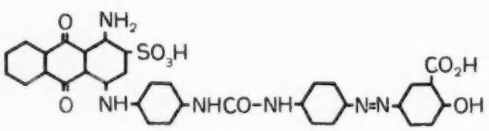

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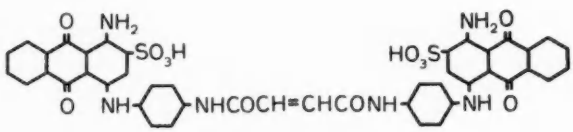
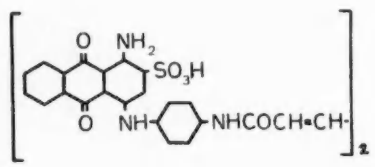


146 Sandoz



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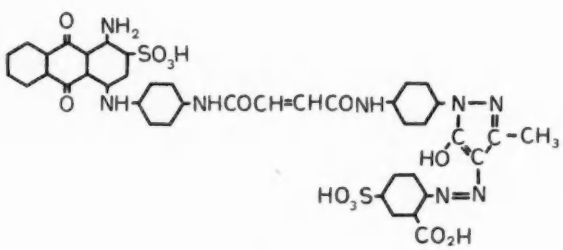

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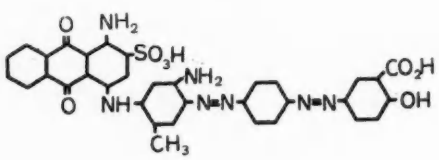


149 IG

eling molecules. The retarding of exhaustion and the ability of the dyestuff to be desorbed in the bath are evidently functions of a certain affinity for water possessed by the molecules, and in most cases the products proposed as leveling dyestuffs have contained hydrophilic groups. I have limited myself to grouping them by their commercial origin in Tables IX and X.

It will be noticed that there is a tendency to greater affinity for water in the case of the dyestuffs of the Saphirol A (Table IX, formulas 93, 94 and 95) and Alizarine Cyanine Green G types (formulas 102, 103 and 104), and in particular with those of the 1 - amino - 2 - sulpho - 4 - p - acetaminoanilinoanthraquinone type, which may be regarded as the initial term of a series of leveling dyestuffs. Leveling properties have been increased by substituting the acetyl by the hydroxyacetyl radical (Table X, formula 112) and by introducing into the basic scheme an additional sulphonic group, either in the anthraquinone nucleus (formula 118) or in the arylamine residue (formulas 119 and 120).

You will say that this leads to incompatibility between the leveling and the milling dyestuffs. This is basically true, but the two classes are not employed in the same fields. Leveling dyestuffs are applied to yarns, piece goods, carpet wools, knitwear, and effect threads. If particularly good fastness to washing is specified, however, the wool must be tow dyed with milling dyestuffs and leveling brought about by a mechanical aftertreatment, such as backwashing, decatizing or milling. Piece dyeing, however, is also practicable with these dyestuffs; it is a purely technical problem, as we mentioned a moment ago. Moreover, the poor leveling properties of the milling dyestuffs can be remedied with external aids such as additions to the dyebaths. This particular aspect, however, lies beyond the limits of the present discussion.

Before passing on to the substantive dyestuffs, I would like to draw your attention for a moment to two groups of acid dyes, the afterchrome colors and acid colors free from sulphonic groups.

D) AFTERCHROME DYESTUFFS ——The members of this class have excellent wet fastness properties when metallized on the fiber. Blues are lacking from the existing range and from time to time proposals are made to fill these gaps with acid anthraquinone dyestuffs. Some characteristic examples are presented in the first part of Table XI. You will note that the basic skeletons of 1-amino-2-sulpho-4-anilinoanthraquinone and Alizarine Saphirol B re-occur in these formulas.

E) ACID DYESTUFFS FREE FROM SULPHONIC ACID GROUPS ——Some manufacturers have taken out patients in which dyestuffs free from sulphonic acid groups are claimed. They are fixed by groupings other than sulphonic acid radicals and owe their solubility to different atomic arrangements, eg, quarternary ammonium salts (Table XII, formulas 128 and 129), isothiouronium (130), sulphonylurea (131), phosphoric acid esters (132), and carboxylic acid groups (133 and 134). The two carboxylic acid groups of dyestuffs No. 135 form insoluble phthalimides with the amino groups of the wool. Work on these dyestuffs does not appear to have been continued, however, as they have not fulfilled a practical need.

SUBSTANTIVE ANTHRAQUINONE DYESTUFFS

Alizarine Direct Blue A2G has a certain affinity for cotton, and when applied to wool-cotton mixtures it does not reserve the cotton. The benzoyl derivative has even more pronounced affinity for the cellulosic fiber and this is further enhanced by an acyl radical to a degree which has rendered dyestuff No. 139 in Table XIII patentable as a direct cotton dyestuff. Acylation of 1-amino-2-sulpho-4-p- phenylenediaminoanthraquinone by a diacid (phosgene or terephthalic acid) also increases the affinity for cotton (formulas 140 and 141), but the best result is undoubtedly that obtained by coupling two anthraquinone molecules by means of cyanuric chloride (142). As the chlorine atoms of the cyanuric chloride react progressively, an anthraquinone molecule can be coupled to a more or less complicated aminoazo molecule (143 and 144), which results in a further increase in the affinity for cotton. The shades of the substantive dyestuffs can thus be extended from blue to a bright yellowish green.

Acylation by a diacid radical to give an asymmetrical dyestuff has also been carried out by the I G Farbenindustrie (145).

Thus, blue direct dyestuffs have been prepared by uniting two anthraquinone molecules of the 1-amino-2-sulpho - 4 - p - phenylenediaminoanthraquinone type by means of a urea bridge, a dicarbonamide bridge, or the cyanuric ring, and direct greens by coupling an anthraquinone molecule and an aminoazo molecule. This approach from the basic skeleton shown in Table I has been adopted to arrive at substantive dyestuffs whose increasing importance has not escaped our notice.

We have recently prepared green direct cotton dyestuffs by coupling two molecules of the same anthraquinone skeleton with the radicals of fumaric and muconic acid. This is the first time it has been possible to synthesize a green substantive dye from two anthraquinone radicals. The deep shade is due to the resonance through the single double bond and the double conjugated bonds respectively (formulas 146 and 147). Similarly, aminoazo and anthraquinone components can be coupled by the action of fumaric and muconic acid (formula 148); in this case the three theoretically possible compositions are formed and together with the asymmetrical dyestuff two symmetrical products are obtained. An appropriate choice of the conditions of reacting and the proportions of the components is needed if the mixture is to possess suitable affinity for cotton. These dyestuffs are the first members of the substantive anthraquinone class which entirely exhaust the dyebath, are insensitive to metals, and have a fastness to light of 7 to 8. They are superior to the dyestuff of the last formula (149), where an attempt has been made to achieve affinity by the accumulation of azo bridges, and are under continuous development.

CONCLUSION

In his memoirs Bally writes that when he joined the "Badische Anilin und Soda Fabrik" in 1888 he was inclined to think that the limit of possible development of the anthraquinone dyestuffs had been reached. Yet within thirty years this single class of dyestuffs has been expanded to such an extent that its members are equal to all the current requirements of bulk application to wool and polyamide fibers. They have also entered the field of the substantive dyestuffs and are a promising element in cotton dyeing.

I do not wish to make any forecast for the future. Professor Fierz once said that a chemist engaged in dyestuff research always has the chance of realizing new progress and becoming "the fortunate successor to the pioneers of the classical period". I make no claim to have been complete, but in speaking to you of recent advance in the field of the acid and substantive anthraquinone dyestuffs, so often underrated in spite of their fastness and properties, I have had in mind the phrase of Alexander Dumas: "If you wish others to speak well of you, speak well of you yourself". I have tried to tell you of these dyestuffs in order that you may think more favorably of them.

• PATENT DIGEST •

SHRINKPROOFING OF WOOL WITH MONOPERSULFURIC ACID———Aftertreatment with Sulfites A,2,04

USPat 2,739,034 (Stevensons [Dyers] Ltd——Fell——March 20, 1956)

USPat 2,701,178, granted to the same inventor [cf *Am Dyestuff Reptr* 45, 959 (1956)] protects the use of permonosulfuric acid or salts thereof under controlled pH conditions in wool shrinkproofing processes.

The current patent modifies this invention: the goods are first subjected to an acid treatment with permonosulfuric acid, then to an aftertreatment with reducing agents, particularly with sulfides or bisulfides.

Permonosulfuric acid . . . H_2SO_5 . . . is the sole oxidizing agent in the first stage of this operation, although the presence of other oxidizing agents, such as peroxide, does not interfere with the effect. It is applied at a pH of less than 8 and at temperatures not higher than 70°C.

Sulfites of alkali, zinc, aluminum, barium, calcium or other metals may be used in the second step at temperatures from cold to boiling. Neutral sulfites are preferred; where acid sulfites are used the goods have to be rinsed after the first-stage treatment. The processing time in both stages can be reduced with increased bath concentration.

The effect of the *neutral* sulfite aftertreatment is illustrated by a table that compares the figures obtained in shrinkage testing after milling.

	% shrinkage
Untreated	23.1
Permonosulfuric acid pH 2.2	21.1
Same plus zinc sulfite	3.8
Zinc sulfite alone	22.0

Thus the effect of the combined treatment becomes evident.

Example: Scoured damp wool was passed first for 1.5 sec through a solution of 36 pbw permonosulfuric acid in 1000 water at 25°C; the pH was adjusted to 0.5 with sulfuric acid. The fabric was squeezed, aired for 10 sec and immersed for 30 sec in a solution of 100 pbw sodium sulfite in 1000 water at 25°C, rinsed and finished as usual.

The use of *acid* sulfite is described in another example (#4). The goods are neutralized in this event with soda ash, rinsed alkali-free and subjected to a treatment with potassium bisulfite at pH of 4.7.

Among the references cited by the Patent Office:

USPat 2,701,178 (see above).

PAUL WENGRAF

French Pat 784,828 (also Brit Pat 451,026 and 451,113) (E Franz): bleaching wool with oxidizing agents, among them monopersulfate.

Brit Pat 579,584 (Bleacher's Assoc/1945): use of bisulfite treatment in shrinkproofing processes with the purpose of opening the disulfide bonds. This pretreatment is followed by a treatment with peroxide, perborates or percarbonates.

Brit Pat 614,966 (Brit Cotton & Wool Dyers Assoc/1948): pretreatment of wool with metal salts (Cu, Ni, Hg) followed by a shrinkproofing treatment with oxidizing agents, such as peroxide, perborates or percarbonates.

DYEING ACRYLONITRILE FIBERS BY CUPROUS-ION TECHNIQUE———Vanadium, Molybdenum or Tungsten Salts Added C,4,07

US Pat 2,729,533 (Du Pont——Glazer Jr, Speck ——Jan 3, 1956)

The preamble to this patent refers to the well-known difficulties in dyeing textiles consisting of polymers of acrylonitrile. This term is understood to comprise any homopolymer or copolymer of acrylonitrile containing at least 40% of the monomer $CH_2{=}CH.CN$. In recent time the cuprous-ion technique has proved to be very efficient in dyeing these fibers with acid wool dyes (see references below).

This technique requires, in many cases, operating at temperatures above the boiling point of the bath, and accordingly, special equipment permitting dyeing under pressure.

It has been found that desired dyeing effects may be obtained in the cuprous-ion technique quite generally at *considerably lower temperatures* by adding water-soluble, noncomplex salts of vanadium, molybdenum or tungsten to the dyebath in an amount of 0.2-0.3% (maximum 1%) of the salt calculated from the textile's weight. Ammonium vanadate is preferred but the corresponding sodium or potassium salts may be applied as well.

The preferred bath temperature is at the boil; it could be reduced even to 206°F in special cases. Thus, in many instances dyeing could be carried out in conventional equipment rather than in pressurized vessels.

The optimum pH of the acid dyebath is at 3-4.5, optionally at 5. Stronger acidity must be avoided because of slower dyeing rate.

Example: Drawn polyacrylonitrile continuous filament was dyed in a bath containing

0.2% ammonium vanadate

3.0% aqueous glyoxal solution (30%)

2.8% $CuSO_4 \cdot 5\,H_2O$

2.0% blue acid dye of Pr 12 (Anthraquinone Blue SWF)

A light blue dyeing resulted, whereas practically no color was obtained in the absence of ammonium vanadate.

References cited by the Patent Office:

Am Dyestuff Reptr 40, 750 (1951): abstract of an article by Feild and Fremon in *Textile Research J 21*, 531-9 (1951) discussing the cuprous-ion technique. Copper has been found to be a dyeing assistant in its own right; formation of a bridge between fiber molecule and dye may best explain this effect.

Am Dyestuff Reptr 41, P75-7 (1952) (Turnbull, Jr): the dyeing of Orlon acrylic fibers and the use of different carriers in these processes is discussed.

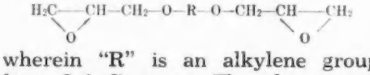
Tech Bull (du Pont) 7, 45-7 (March 1951) describes the cuprous-ion technique in dyeing Orlon acrylic fibers with acid dyes, using Sulfoxite C as a reducing agent.

SHRINKPROOF TEXTILES—Diglycidyl Ethers Applied A,2,04

USPat 2,730,427 (Am Cyanamid——T J Suen ——Jan 10, 1956)

The current invention refers to shrinkproofing and creaseproofing processes for *all kind of textiles*, including wool, cotton, rayon and so on.

Good effects reportedly are obtained by impregnating the goods with 2-30 (preferably 5-15) percent of a compound of the formula



wherein "R" is an alkylene group from 2-6 C atoms. The above percentage of the compound is based on the dry weight of the textile material.

The impregnated textiles are dried in any convenient way and cured at temperatures between 50-200°C, optionally in the presence of a catalyst. The epoxy rings are opened in the curing step, causing the compounds to react with the functional groups of

the fiber molecule. Glycidyl ethers to be used in this process include ethylene glycol bis glycidyl ether, hexamethylene glycol bis glycidyl ether and many similar products of this group.

Example: Wool serge was treated with a 10% aqueous solution of hexamethylene glycol bis glycidyl ether and dried at 40°C in an air current for 20 min. The dried cloth showed a pick-up of 7.5%; it was cured at 300° F for 30 min. The cloth so treated was found to shrink only 1/3 of the value of a nontreated specimen of the same provenience.

Among the references cited by the Patent Office:

USPat 2,606,810 (Am Cyanamid/1952): shrinkproofing of wool with polymers of glycidyl esters of unsaturated acids [cf *Am Dyestuff Reptr 42*, 213 (1953)].

USPat 2,252,039 (Heberlein Patents Corp/1941): water-repellent process which calls for heating fibrous materials with epoxy compounds of higher chains, eg, the glycide ester of montanic acid.

USPat 2,500,449 (Shell Develop/1950): resinous compounds for varnishes, etc, obtained by reacting and curing glycidyl ethers with oxalic acid.

USPat 2,500,600 (Shell Develop/1950): producing curable resins from glycidyl ethers, eg, glycidyl ether of glycol, and aliphatic diamino products, such as 2-4-diamino-2-methylpentane.

WATERPROOFING EMULSIONS

———Organosilicon Compounds plus Triethanolamine Titanate C,2,02

USPat 2,735,791 (Soc Us Chim Rhone-Poulenc ——Peyrot, Proriol——Feb 21, 1956)

Waterproofing compositions based on butyl titanate, also combined with organosilicon compounds, have been described in the past [cf digest of Monsanto's USPat 2,716,656/1955, *Am Dyestuff Reptr 45*, 983 (1956)]. These finishes must be employed in the form of organic solutions.

The inventors have developed a waterproofing composition to be applied from aqueous emulsions, comprising as components:

a) a methylpolysiloxanic resin . . . 20-60% (preferably 25-50%)
b) a methylpolysiloxane oil . . . 25-50% (preferably 25-45%)
c) triethanolamine titanate . . . 8-40% (preferably 8-20%)

ad a) The resin is obtained by hydrolysis of methylchlorosilane in ethereal solution and used in benzene or toluene solution.

ad b) The methylpolysiloxane oil is prepared by known methods; it is a thick liquid of viscosity of 50-30,000 centistokes.

ad c) Triethanolamine titanate is produced by reacting a titanic ester with triethanolamine.

Components "a" and "b" are dissolved in a common solvent, eg, in chlorinated or unsubstituted hydrocarbons; "c" is added in the amount desired and the ingredients are emulsified with a triethanolamine soap or with a condensate of a fatty amide, eg, Pluramine S 100. This emulsion, termed as "parent emulsion A" can be diluted with water down to a solid content of 1-5%. A convenient method of preparing the emulsion in concentrated and stable form (25% solid content) is to mix "a" and "b" first with the emulsifier and to add thereupon the necessary amount of triethanolamine titanate.

A durable finish on textiles or paper is reportedly obtained by impregnating, calendering repeatedly and heating to 100-200° C for one to 30 min.

Other known water repellent agents can be combined with the patented emulsion.

Example: The parent emulsion A consists of 8 p triethanolamine titanate; 35 p methylpolysiloxane resin (a) applied in a 70% toluene solution; 25 p methylpolysiloxane oil, viscosity 300 centistokes (b); 14 p trichloroethylene; 0.5 p oleic acid and 2 p triethanolamine; and 150 p water. This emulsion was diluted to 2% solids content and used to impregnate a cotton poplin fabric. The specimen was dried at 150° C for 10 min and tested according to the hydrostatic test II and the spray test (ASTM-D583-50T) with the following results:

	Pressure Test	Spray Test
After drying	14.5	100
After 45 min scouring at 55° C	12.5	90

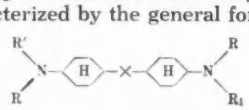
No references are cited by the Patent Office.

CELLULOSE DERIVATIVES DYED WITH ACID DYES

———Bicyclic Bases Used C,4,07

Brit Pat 742,029 (Bad Anilin- & Sodafabrik——Dec 14, 1955)

Very fast dyeings or prints on cellulose esters or ethers with water-soluble acid dyestuffs can be obtained by incorporating before or during the dyeing process certain *water-insoluble bicyclic saturated basic compounds* characterized by the general formula:

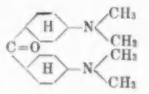


wherein ⟨H⟩ stands for cyclohexyl; X for methylene, CO or NH; and R and R′ for H, alkyl or cyanoalkyl

Examples are:

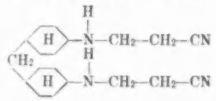
for a tetra-alkylated compound:

N N,N′,N′—tetramethyl 4—4′ diamino dicyclohexyl ketone



for a cyanoethylated compound:

bis(cyanoethyl amino-cyclohexyl) methane



These bicyclic saturated basic compounds were found to have a strong affinity for cellulose ester fibers, particularly when substituted for cyanoalkyl groups. They can be incorporated from aqueous dispersions before the dyeing process; the dyeing process follows in a second step. Simultaneous application of the basic assistant is only possible where the acid necessary for dyeing is added or liberated in the course of the dyeing process only. In this event the basic compound is already bound to the fiber at a time when the acid dye starts to be absorbed.

Another method for using the basic assistants is to solubilize them, preferably by transforming them into their bisulfite-formaldehyde derivatives or by forming their water-soluble salts with organic or inorganic acids. In both events the addition compounds, being soluble in cold water, dissociate slowly upon being heated in the dyebath, causing gradual absorption of the basic assistant.

The incorporation of the basic compound in the spinning mass before extrusion is within the scope of this invention.

Example: 100 p of an acetate rayon fabric was treated for an half hour at 75-80° C in a bath containing 4 p of the bisulfite-formaldehyde derivative of the above-mentioned cyanoalkyl-substituted compound. The fabric was then rinsed and dyed with a blue amino anthraquinone sulfonic acid dye and sulfuric acid at 75-80° C for ½ hr. A deep blue dyeing, fast to light and wet treatments reportedly resulted.

Reference may be made to US Pat 1,855,278 (Gen Aniline/1932) describing a dyeing method for cellulose acetate with water-soluble acid dyes (Orange I), direct dyes (Benzobrown G), and basic dyes (Methylene Blue or Safranine) by adding to the dyebath hexahydroaniline or substitution products thereof, such as hexahydromethylaniline. Brit Pat 493,782 (H Dreyfus) has a similar content. Both patents apparently refer to mild saponification methods only and neither mentions the application of dicyclic saturated basic compounds, as advocated in the current specification.

Abstracts

International Competition in Textiles

Allen, G C, *J Textile Inst* 47, P389-91, April, 1956.

The speaker said that it might be of interest to hear how some of the problems of the textile industry appear "from outside".

The textile industry is one of the principal economic activities, he said, and no one country now enjoys predominance, as Great Britain did before 1914. Today, textile industries flourish almost everywhere. It follows that textiles constitute a highly competitive field, and most countries have access to up-to-date techniques. Clearly, it is only by a "continuous preoccupation" with efficient methods and with improvements in technique and commercial matters that any particular textile industry can hope to develop, or even survive. Success can come only by doing superlatively well what others do indifferently, or by discovering how to produce and sell new varieties of products that others have not yet devised.

In considering international competition, it is meaningless to discuss it in terms of "fair shares". In economic life the share of a market which a particular firm or industry can obtain is the share it succeeds in winning by its skill, foresight, or luck.

The speaker pointed out that at the end of the 19th Century India was getting a high proportion of the cotton she consumed from England. Just before World War II India was meeting most of her textile needs herself, but she still imported large quantities from England and Japan. Now she can dispense with both England and Japan and even exports to England.

It may sometimes be possible for a particular industry to be preserved, even if its costs are out of line, by restrictive or protective devices or subsidies; but in the end the prize will go to those who, for some reason, have an economic advantage. This might be due to better equipment, or to cheaper labor combined with high productivity. The only way in which an industry which thinks itself menaced by the cheap labor of its competitors can meet the competition is by raising its own productivity by using more capital and better methods, and by employing its expensive labor more efficiently.

The high or low cost of labor cannot be explained except in relation to the whole of an economy, and until that has been examined, it is better not to stress its effect in terms of "fairness" or "unfairness".

All this has a bearing on economic policy. It is sometimes claimed that it is for the Government to say how resources should be distributed among the country's industries. In a "free society" it is difficult to find support for such a proposition, for it implies that "a few over-worked civil servants" must have available technical and economic data in immense detail for all the industries of the country and of competing countries, and be able to predict changes for many years ahead. A government has no power to make sensible centralized decisions in such matters. It can deal with contingencies only, which are sure to arise.

In the technical field, this is a task of supreme importance for economic progress, and in the case of England, for economic survival.—WHC

Silicones: Textile and Other Applications

Cuthbertson, W W, *Textile Mfr* 82, 320, June, 1956.

The main property of silicones, rendering them of interest to the textile industry, is that of water-repellency, which is possessed by almost all silicones, whether they be fluids, resins, or rubbers. The fluids especially, when applied to textiles, impart water-repellency without affecting the breathing properties of the fabric, a very important factor as far as the comfort of the wearer is concerned. The silicone fluids, therefore, are water-repellents, rather than water-proofers, and give what is now known as a "shower-proof" finish on textiles. Before silicone treatment of any fabric, all traces of size and wetting agents should be removed by washing in warm water, otherwise the adhesion and water-repellency of the finish will be impaired.

One type of silicone fluid is a dimethylsiloxane polymer, applied as an emulsion in presence of a mordant, zirconium oxychloride, which forms co-ordinate linkages with groups in the textile fiber and also with the silicone. The cloth is padded with this material, dried, and baked at 150°C. This emulsion is suitable for application to nylon, Terylene, acetate and viscose.

For cotton fabrics, a different type of emulsion is necessary, to avoid tendering. This is based on a polymer having hydrogen atoms attached to the silicon, which enable it to be cured by a metal/organic salt such as zinc or tin naphthenate or octoate.

Silicone finishes have excellent durability to washing and dry cleaning, the water-repellency being substantially unaffected after five severe washes. Other advantages of silicone-treated fabrics are a softer hand and an increased resistance to water-borne stains, such as ink, milk, fruit-juice, etc.

The author also discusses the application of silicones to leather for water-repellency. At present this treatment is limited to chrome tannages.—WHC

Recent Developments in Wet Processing and Finishing*

The increased use of the hydrophobic man-made fibers, now up to more than 400 million pounds annually, has presented problems and areas for progress and development in wet processing and finishing.

Chemical treatments have been utilized to control static and to improve spinning and weaving. New dyes and new dyeing techniques have been adopted.

Advances have been made in functional and aesthetic finishing wherein chemical technology has played a major role.

The increased use of the synthetic fibers has in part sparked the development of improved wet processing and finishing treatments for natural fibers, cellulose and wool. Again, materials made available by the chemical industry have been utilized to improve the characteristics of the textile articles, increasing their consumer acceptability.

Recent developments having an impact on the chemical and textile industry include the discovery of new dyestuffs; new methods of application; new materials for modifying frictional characteristics of fibers; new shrink-resistance treatments for woolen and worsted fabrics; new stabilization treatments for cellulosic fabrics; new antisoiling treatments; new flame-resistant treatments and other functional finishes. The new products and processes are discussed.

* Presented by Hillary Robinette, Jr before the 29th Congress of the French Society of Chemical Industries at the Parc des Exposition—Porte de Versailles, Paris, France, on November 23, 1956.

Proceedings of the
American Association of Textile Chemists and Colorists

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January 14, 1957

PROGRESS REPORT—AATCC RESEARCH*

INCOME RECORD IMPROVED———Substantial gains were made in this period by the National Corporate Membership Committee in the enrollment of new members and in adjustments of present members to the new dues schedule introduced early in 1955. This made it possible to realize some progress toward the objectives set forth in the expansion program undertaken by AATCC Research last year.

Income credited to the Research Fund rose from $53,834.70 in the preceding period, to $64,309.85. The budget has again been set at $65,000 for the period ending next July to keep within current receipts. However, it is anticipated that new income this coming year may allow expansion of budgeted requirements beyond this amount. The ultimate income goal for AATCC's research operations continues at $100,000 per year, some three to five years hence.

RESEARCH POLICY STRENGTHENED———The Executive Committee on Research made considerable progress toward a strengthening of policies governing all research activities. A special committee on interorganizational affairs was activated by the Council to carry on a more clearly defined program of cooperation with other technical groups and government agencies. Appointments were made for cooperation with the American Standards Association in an advisory capacity to assure proper use of AATCC test methods in the current development of ASA textile standards. Other representatives are working with the US Bureau of Standards to modernize Commercial Standard CS 59 and bring it into line with AATCC test methods.

*Mailed to Corporate Members on Dec 21, 1956.

STAFF COMPLEMENT INTACT———The staff of AATCC Research numbers ten individuals, including five research associates, the director, and laboratory and clerical assistants. A full time research associate was retained to replace the late Edwin Johnstone, who for several years held a key post on the staff and made many contributions in the development of standard test methods, notably the Flammability Test.

NEW LABORATORIES PLANNED———AATCC Research will have new laboratory facilities in about three years as a result of the Council's acceptance early this year of an offer from the Lowell Technological Institute to construct a special wing to house AATCC's entire administrative and technical departments in a new building now under way on the LTI campus. As in the past, AATCC will occupy the space without any rental charges.

ISO STANDARDS ADVANCED———Plans were completed by the Executive Committee on Research for meetings held in September, 1956 of the International Organization for Standardization, under Sectional Committee L23 of the American Standards Association. AATCC jointly holds the secretariat of the ISO Committee on Colorfastness Tests with the British Society of Dyers and Colourists, as well as heads the Committee on Shrinkage of Fabrics in Washing. This was the fifth conference held in England and United States and marked the latest stage of progress being made in the adoption of international test methods. Many tests have been approved, only a few remain for completion at future meetings of these committees.

TEST RESEARCH ACTIVE———Test methods research moved forward at an accelerated pace notably in the fields of lightfastness, wash and wear, end-use, shrinkage, antimicrobial finishes, and abrasion. Sunlight exposure studies were conducted in Phoenix, Chicago, Miami, and eastern locations. Over ten thousand specimens were tested and evaluated. In the difficult field of abrasion testing, an entirely new concept of testing was initiated by the staff using the relatively new AATCC-developed instrument—the Accelerotor. This high-speed machine is capable of reducing testing time from days or weeks to minutes for evaluations of the wear life of textiles. Applications of this instrument include evaluations of detergents, standard soils, pigment fixation, color penetration, quality control of resin application and shrinkage of fabrics.

CHALLENGE OF INDUSTRY NEEDS———AATCC Research finds it difficult at times to meet adequately the needs of industry for research in the use of test methods because of limited staff and equipment facilities. With some thirty-seven active committees in operation, comprising over three hundred representatives of industry, the demands on AATCC Research are infinitely varied and often highly complex. Notwithstanding this fact, the progress shown this past year in terms of both research production and growing financial support from Corporate Members, assures steady growth of this vital program in the future.

On behalf of the Council, the Executive Committee on Research expresses appreciation for the loyal and continuing support of the 332 Corporate Members which now comprises this important branch of AATCC operations.

Respectfully submitted,
CHARLES W DORN, CHAIRMAN
EXECUTIVE COMMITTEE ON RESEARCH
December 15, 1956

NEW CORPORATE MEMBERSHIP CERTIFICATES ISSUED

NEW certificates of membership were mailed to Corporate Members in November. The president's message accompanying the certificate is reproduced below.

Also shown is the new, plastic finished, laminated wood mounting boards for display of the certificates. This type of mounting may be had in a selection of walnut, mahogany or blonde finishes at $10.50. The certificate must be returned with the order.

If Corporate members care to display their certificate in several locations, duplicate copies of the certificate itself may be ordered at $2.00 each from AATCC headquarters in Lowell, Mass. These will be unmounted. Mounted copies are $10.50 each.

If you want an extra certificate for your office, contact the executive officer in your firm who is in charge of Corporate Membership relations with AATCC.

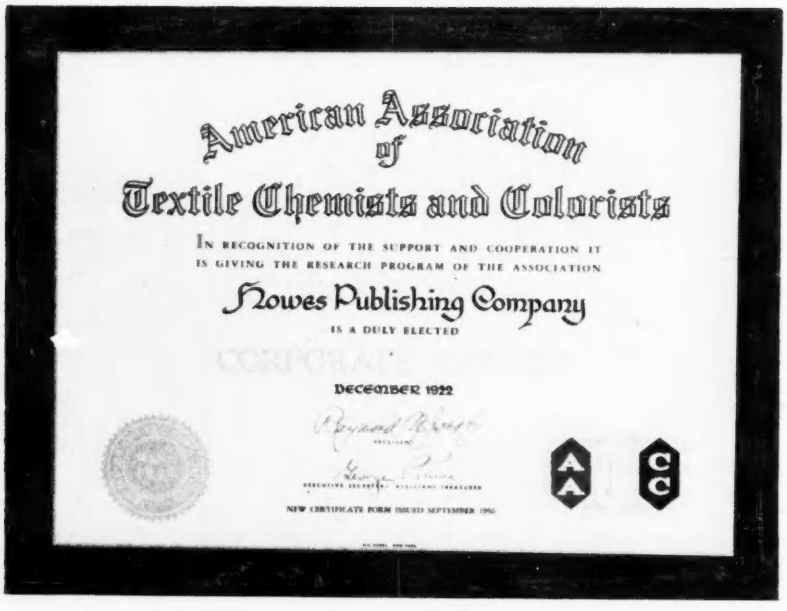
WE take pleasure in sending you this new certificate of Corporate Membership as evidence of your continuing support and cooperation in AATCC's Research Program.

Many firms have been corporate members since the founding of our research organization in 1941 at Lowell Technological Institute. This long and enduring support is in itself an indication of the fundamental character of the needs of the textile industry being served by this program.

AATCC Research, through its hundreds of participating technical representatives of textile organizations, has provided important leadership and direction to a research activity that is vital to the future progress and welfare of the industry.

By your display of this certificate you not only show your own proud support of this research, buf you encourage the support of others who will see it.

Raymond W Jacoby
PRESIDENT



New York Section———

WET PROCESSING OF LUREX*

LEON E SEIDEL
Lurex Yarn Div, The Dobeckmun Co

Lurex is a ribbon-shaped metallic yarn consisting of four components in sandwich form: an aluminum base; a protective plastic film, which is laminated to both sides of the aluminum; a laminating adhesive; and a pigment dispersed in the adhesive in metallic effects other than silver. The three basic types of Lurex in common use, with special emphasis on the effects of cotton, synthetics, and wool processing on each type, are discussed. Recommendations are made as to the conditions of time, temperature, and concentrations best suited to Lurex yarns.

* Presented before the New York Section at Kohler's Swiss Chalet, Rochelle Park, NJ, on October 19, 1956.

INTRODUCTION

IT HAS been 10 years since the Dobeckmun Company, which is not a prime producer of textile yarns by origin, started to produce Lurex. The reason for my being here to speak this evening is based on the somewhat astonishing growth of Lurex yarns during this 10-year period. Our company volume has grown from $9,000,000 in 1946 to $44,500,000 in 1956, and a good share of this is represented by Lurex sales.

In the beginning, only gold and silver yarns of the butyrate Lurex type were available, and now we stock over 400 different size and color variations of three basic types. This is further enlarged by a usage of these variations in over 15,000 supported combinations. From the standpoint of end use, our original yarns were directed primarily to dress fabrics, and now Lurex is fabricated for an assortment of usage which includes automotive upholstery, home furnishings, linens and domestics, dress goods and the like; also in the beginning most Lurex yarns were used in yarn-dyed fabrics, and now piece dyeing of fabrics containing Lurex is quite practical.

It is this last growth pattern with which we are concerned this evening. We must state at this point that Dobeckmun is a company that is not experienced in dyeing and finishing textile materials. In order to formulate a technology, we called upon some 30 mills, dyestuff manufacturers and textile chemical manufacturers, all of whom were AATCC members. We wish to acknowledge the wonderful cooperation which we received. The evaluation summary presented here and the information soon to be released in bulletin form by our technical service department has been made possible almost exclusively through this group effort.[1]

[1] The Dobeckmun Company has since introduced to the textile industries of the United States and the United Kingdom bulletins on the techniques of working with nontarnishing metallic yarns. The bulletins treat of Dobeckmun yarns only: Lurex, Lurex-MM (metalized Mylar) and Lurex-MF (Mylar and foil).

Bulletins I-VII comprise: Introduction, Properties, Twisting, Winding, Quilling, Warping, and Weaving. Bulletin VIII is devoted to wet-processing, ie, preparation for dyeing, dyeing, finishing, and drying and curing.

These may be obtained from: The Dobeckmun Co, 350 Fifth Ave, New York 1, NY.

DISCUSSION

The general result of our evaluation points to the fact that Lurex may be successfully prepared for dyeing, dyed, and finished in a wide, practical range of wet processes. The optimum selection of conditions in order to achieve this success depends on six factors:

1) Type of Lurex present in the fabric.
2) Color of the Lurex.
3) Chemical nature of the particular Lurex type.
4) Mechanical action in the process.
5) The nature of the fibers accompanying Lurex in the fabric.
6) Manner in which the Lurex has been fabricated.

Lurex is not a generic term which describes all aluminum-base metallic yarns. This term refers specifically to the metallic yarns originated and manufactured by the Dobeckmun Co. Because of this, the wet-processing information suggested here is applicable only to fabrics containing yarns which have positively been identified as Lurex.

There are three basic types of Lurex (see Figure 1); all are ribboned-shaped aluminum yarns protected by plastic films. The layer assembly of the Lurex "sandwich" is somewhat different for each of the three basic types. Since the nature of all of the components of the layer assembly has a bearing on the chemical behavior of Lurex in wet processing, it is quite important to properly identify the yarns before exposing them to any processing. If this information is not readily available from the fabric source, identification may be effected by an analysis procedure which we will be happy to provide upon request.

A key to interpreting chemical property data into practical usage guides centers about the fact that Lurex is a heterogeneous yarn; it is

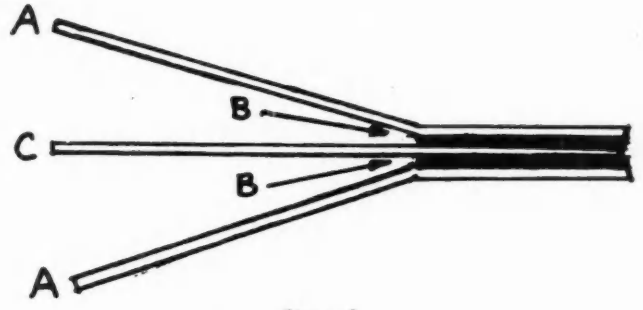


Figure 1
Basic types of Lurex

Type	A	B	C
Butyrate Lurex	Cellulose Acetate Butyrate	Adhesive	Aluminum Foil
Lurex MM*	Mylar**	Adhesive	Metalized Mylar
Lurex MF	Mylar	Adhesive	Aluminum Foil

* Registered trademark of the Dobeckmun Co
** Du Pont's polyester film

composed, as has been seen, of two layers of clear plastic, an aluminum or aluminum coated (metallized) base, two layers of adhesive, and in Lurex colors other than silver, a pigment dispersed in the adhesive. Color may also be applied to the underside of the clear film members by rotogravure printing. The manner in which Lurex behaves in wet processing in some measure depends upon all of these components.

This precludes the fact that Lurex protected with cellulose acetate butyrate film corresponds exactly in its wet processing behavior to acetate yarns and that Lurex protected with Mylar film corresponds exactly in its wet processing behavior to Dacron yarns. Generally these comparisons hold true only when considering dye affinity for the film portion of the Lurex yarn.

An important reason for these conditions is the fact that the ribbon-shaped yarns are manufactured in a variety of widths by means of a slitting operation; each edge of the ribbon exposes a cross section of the entire layer assembly to the particular wet process.

Examination of the chemical nature of Lurex as it applies to practical wet processing provides some general guides in handling and, we might add, that these general statements apply primarily to gold and silver Lurex.

All types may be boiled in time cycles up to 8 hours depending on the affect of the materials in the bath on one or more of the Lurex components. In butyrate Lurex, because the aluminum portion of the yarn is a good conductor of heat, the relatively low wet heat resistance of the cellulose acetate butyrate film does not necessarily determine the behavior of the whole yarn. What can happen is that exposure to elevated wet temperatures for periods of time over an hour can cause the protective film to blush or become cloudy. This is due to hydration of the film and/or adhesive used and may be cleared by drying for 3 minutes at 300° F. Lurex-MM and Lurex-MF do not readily blush in wet heat and can be processed at elevated temperatures under most commonly used conditions.

All Lurex may be exposed to dry heat on wet and dry textile materials under conditions normally encountered in drying and curing without any effect on the Lurex. Super-heated drying media, however, should be avoided. With butyrate Lurex, if pressure is applied in conjunction with dry heat, temperatures should be limited to moderate ranges because of the thermoplastic nature of the adhesive used to bond the Lurex layer assembly. Heat with pressure in excess of about 225° F can cause shifting of the film away from the aluminum-foil base. When dry heat is applied to butyrate Lurex, which contains moisture in film and adhesive at temperatures over 300° F, the rapid conversion of this moisture to steam can cause delamination, and such conditions should be avoided. Lurex-MM and Lurex-MF are similarly limited in cases of dry heat with pressure to 275° F in the MM version, and 300° F with MF.

Optimum handling in wet processing of Lurex-bearing fabrics is carried out in a neutral bath at moderate temperatures. All Lurex, however, is resistant to moderate concentrations of acid at low to moderate temperatures. When butyrate Lurex is exposed to sulfuric acid in neutralizing operations, this type of yarn is best exposed in a cold, extended time cycle rather than in high temperature short cycle. Sulfuric, as well as salicylic, benzoic and formic acids in heavy concentrations and high-temperatures can delaminate and discolor butyrate Lurex. Under the same conditions, acetic and oxalic may be successfully employed. Moderate-to-heavy concentrations of hydrochloric acid at elevated temperatures may remove the aluminum from butyrate Lurex. With Lurex-MM and Lurex-MF, we have a somewhat different condition: these types have generally excellent resistance to acids under most practical wet-processing conditions. Lurex-MF is somewhat more resistant to salicylic, benzoic and formic acid than is Lurex-MM, which can delaminate or lose metal under severe exposures. Moderate to heavy concentrations of hydrochloric acid at elevated temperatures can remove the aluminum from Lurex-MM and Lurex-MF also.

Since aluminum is readily attacked by sodium hydroxide and because there are 2 exposed edges of aluminum in the Lurex layer assembly, the use of this material should be carefully controlled in conjunction with *all* Lurex, and avoided where possible. Caustic attack on Lurex exhibits loss of metallic luster through "etching" out of aluminum yarn members. Temperature and principally time of exposure determines the occurrences and the extent of the etching effect in Lurex. In butyrate Lurex, where caustic exposure is properly controlled, concentrations common to mercerizing and vat dyeing will not remove the aluminum from this type. Consideration, however, of a saponifying effect on the cellulose acetate butyrate film is vital for this yarn. With Lurex-MM, caustic concentrations common to cotton processing *will* etch the Lurex, and these processes and any other requiring the use of caustic soda should be avoided in processing this type. Lurex-MF will successfully withstand caustic concentrations common to cotton processing, and no saponifying effect occurs in this type.

Chlorine, peroxide, and sodium chlorite bleaches have no effect on any Lurex type under properly controlled conditions. The use of caustic soda in peroxide bleaches should be minimized and where the saturated goods are stored for extended periods of time, there is a danger of etching. Cold overnight H_2O_2 bleaches should be avoided on all Lurex types. Dyed fabrics containing Lurex may also be stripped successfully.

Common salt has no effect on any Lurex type under commonly used conditions. Soda ash, however, can etch aluminum from all types at elevated temperatures in moderate to heavy concentrations. The use of copper sulfate should be minimized on fabrics containing Lurex under the same conditions for the same reasons.

All Lurex types are resistant to the effects of commonly used drycleaning solvents (Stoddard's solvents, carbon tetrachloride, and perchlorethylene). Trichlorethylene should not be used on fabrics containing Lurex-MM and MF. The same holds true for acetone on all Lurex types, as it has destructive effects on the protective film or the adhesives, depending on the yarn in use.

Wool spinning oils commonly used in this country of the mineral and vegetable type generally have no effect on any Lurex type under prolonged periods of exposure; depending on formulation, animal oil emulsions may tend to delaminate butyrate Lurex, and therefore should be applied only on the basis of careful trial.

It is generally desired to dye the fibers accompanying Lurex leaving the metallic yarn as it was originally placed in the fabric. By proper selection of Lurex type and dyeing conditions, all classes of dyestuff may be successfully applied to the ground portion of the cloth without staining the Lurex or disturbing its layer assembly. The reserve of a particular dye for the film portion of Lurex may be evaluated on the bases of the reserve of this same dye for white acetate yarn in the case of butyrate Lurex, and white Dacron, in the case of Lurex-MM and Lurex-MF. Where

it is desirable to provide "colored" Lurex by piece dyeing for cross or union effects, butyrate Lurex may be successfully dyed with disperse dyes, and Lurex-MM and Lurex-MF with the same class with or without a carrier. When dyeing for Lurex, dyeings are most suitably carried out on silver Lurex. Within the limits of careful selection of procedures and dyestuffs for good Lurex reserve, and provided that the Lurex of the butyrate type has not been saponified in preparation, the following general classes of dyes will not stain or otherwise disturb the original metallic luster of Lurex:

For butyrate Lurex———directs, developed directs, vats, leuco vat esters, naphthols, acids, chrome dyes, and sulfurs.

For Lurex-MM the same general classes are applicable, with the exception of vats. The caustic generally used, even in short exposure common to continuous vat dyeing, can etch this type of Lurex. In addition to this list, disperse dyes in selected colors at low-to-moderate temperatures may be successfully applied without staining this type.

With Lurex-MF we have our most versatile yarn from the standpoint of dyestuff application. Vats by continuous, pad jig, and jig methods may be applied to this type, as may disperse dyes under controlled conditions.

Generally, all Lurex types may be satisfactorily treated with finishing agents to provide such characteristics as softness, weighting, crease resistance, proofing and repelling properties, and the like. For the most part, these functions are imparted only to the fibers accompanying the Lurex in the fabric. The range of procedures required to apply these materials have no tendency to disturb the Lurex.

The quality and efficiency of Lurex handling in fabrication by weaving and knitting depends almost entirely on one factor: *Tension control.*

The percentage which Lurex elongates varies with the type. The percentage of stretch, and yield points for the three basic types of Lurex, for the most commonly used width of 1/64" is seen in Figure 2. If mechanical operating tensions exceed yield points, over-stretching can occur and the yarns may be rendered dull, weak, and brittle. Further, the chemical resistance of the particular Lurex type can be appreciably decreased. The increased sensitivity to chemical attack due to over-stretching is particularly critical in the high-stretch Mylar-protected Lurex types.

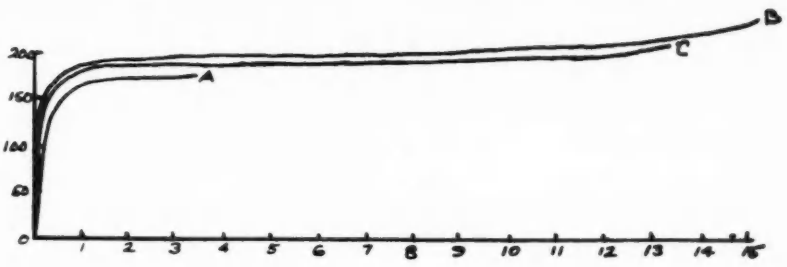


Figure 2

A—Butyrate Lurex B—Lurex MM C—Lurex MF

The second consideration of the greige fabric, before exposure to wet processing, applies primarily to woven fabrics and concerns the direction in which the Lurex runs in the fabric. Depending on the type of Lurex used, this will influence the nature of mechanical handling selected for a particular process. Generally, Lurex in the warp is more critical in this respect than when used in the filling.

A third general consideration concerning greige cloth construction involves the length of the Lurex floats. Again, depending on Lurex type, float length will dictate selection of mechanical handling techniques in the wet process to prevent such fabric disturbance as breakage by catching or burial of Lurex in the fabric. Long floats are less apt to become embedded in the cloth but at the same time they are more susceptible to snagging and breaking by roll action. In fabrics in which the warp or filling yarns accompanying Lurex shrink to a great extent in wet processing, long Lurex floats will tend to loop more noticeably than will a tightly woven Lurex yarn.

Provided the proper Lurex is used, wet-processing conditions may usually be selected for the ground fiber or fibers which accompany it. There are a few considerations, however, which will contribute to maximum wet processing quality and efficiency in this connection.

The shrinkage of the ground fiber versus the shrinkage of the Lurex is the first. Generally, Lurex is a dimensionally stable yarn. When combined with fibers which have a high normal shrinkage in wet processing and which are mechanically dimensionally stabilized, the Lurex may loop up, particularly when fabricated in long floats. This is particularly important in connection with wool fulling and compressive shrinkage. In the fulling operation, shrinkage of the fabric may be controlled in the warp, to as little as 3 to 5%, and fabrics intended for fulling are therefore best constructed with the Lurex in the warp and the shrinkage warp-wise closely controlled.

The second consideration is the effect of chemicals retained by the accompanying fibers on the Lurex. This effect is an important one when accompanying fibers are adjacent to Lurex yarns in the fabric and remain in some kind of saturated condition for long periods of time. An example of this is a cotton and Lurex fabric containing moderate-to-heavy residual caustic concentrations which can, particularly under drying conditions, attack the aluminum portion of the Lurex. Mercerized fabrics which have not been thoroughly washed and even soured can also cause this effect. Another example involves exposure of Lurex to adjacent woolen yarns which have been spun using animal-type oils. In certain cases, these oils can, upon storage, delaminate butyrate Lurex. These examples suggest two check points: *first*, a thorough washing or neutralization of fabrics containing materials which can disturb Lurex on extended exposures, and *second*, the avoidance of use of those materials on fibers accompanying Lurex which can damage the yarns on storage.

Indications of resistance of Lurex to mechanical action in wet processing are tied up with the nature of the protective plastic film on the Lurex and the completeness of the laminating bond of the layer assembly. Lurex-MM has approximately 72 times the abrasion resistance of butyrate Lurex. Considering the fact that Lurex is a layer assembly bonded together by adhesives and that excessive mechanical action on the yarn, particularly when exposed in long float areas, can disturb this assembly, certain normal precautions are suggested for wet processing of Lurex-bearing fabrics:

1) *Breakage and delamination of the protective film portion of the yarn.* This type of mechanical damage, particularly delamination, can expose the aluminum portion of the Lurex and render it susceptible to removal by chemical and mechanical means. This may be avoided by easing up on roller systems through which the fabric passes, particularly if the fabric contains long floats.

2) *Over-stretching of the whole Lurex yarn.* This type of mechanical damage can cause dulling, embrittlement and breakage of the Lurex yarns and render them susceptible to chemical attack in wet processing. It may be avoided by careful control of applied lengthwise and fillingwise tensions. This perhaps may serve as a guide in planning of "gain" in processing, and width control, through use of tentering units.

3) *Abrasion by Lurex on the fabric.* In cases where ground fibers are subject to chafing or rope-making in wet processing, as silk and wool piece goods are, the abrasive action of the Lurex in those fabrics should be noted. Tacking may be used to advantage to avoid this condition.

TABLE I
Lightfastness of Lurex colors (Fade-Ometer hours— AATCC Test 16A-54)

Color	Butyrate Lurex	Lurex MM	Lurex MF
Silver	120+	120+	120
Gold	100	100	90
Xmas red	100		
Scarlet	40		
L orange	40		
Pink	40		
Purple	120		
Orchid	80		
P blue	120		
E blue	120		
B blue	100		
K green	120		
S green	120		
Gunmetal	60		
Black	120		
White	120		

The decorative function of Lurex yarns can vary with the individual case; while it is sometimes desirable to lend a subtle self-colored look to the fabric, requirements generally call for a full, bright, metallic luster. Provided that construction of the fabric is suitable, this effect may be preserved in wet processing through all operations without dulling or disturbing the Lurex in any way. In this connection, selection of the color applied to ground yarns which the Lurex accompanies is most important. Although planning color harmony is not usually the job of the dyer, it should be noted that good contrast between ground and Lurex yarn colors is important to maintain the maximum effect of the metallic yarn decoration.

The color fastness of Lurex in all types is excellent through a wide range of processing and end use conditions. This is true because the Lurex color is applied during manufacture of the yarn beneath the protective film. As such, this color is not exposed to rubbing, and only to a small degree to acids, alkalis, washing, drycleaning, pressing, and perspiration. It must be noted, however, that any process or application which will delaminate or otherwise disturb the yarn also renders the color susceptible to attack. The light fastness of a representative line of Lurex colors as measured by AATCC 16A-54 in Fade-Ometer hours is shown in Table I.

NOTICE

To ensure that the activities of your Section receive proper publicity in the Proceedings, it is desirable that material be submitted direct to American Dyestuff Reporter, 44 E 23rd St, New York 10, N Y.

ADVANCE NOTICES OF MEETINGS———Copy must be submitted *at least two weeks* prior to the publication date. ADR is published on alternate Mondays. It is urged that that dates be taken into consideration when copy is submitted.

Advance notices should include the date and site of the meeting; the speaker's name, position, business affiliation, and subject; a short abstract of the paper (optional); details of additional meeting highlights, eg, nominations or election of officers, special awards, activities of Sectional committees, etc.

MEETING REPORTS———Complete reports should be submitted as soon as practical after a meeting. Information should include attendance figures; captioned photographs of meeting principals (speaker, section officials, etc); and any additional points not covered in the advance notice. An extensive resume of the speakers' remarks is not necessary if the paper is to be submitted for full publication in the Proceedings.

PAPERS———Two copies of each paper presented before local sections should be sent to the offices of the American Dyestuff Reporter. It is very important that every speaker be acquainted with the "Notice to Authors", which appear periodically in the Proceedings. Additional copies of said notice will be sent to section officials on request.

It is imperative that each Section appoint an official whose responsibility it is to see that the speaker's remarks are submitted. In cases where prepared manuscripts are not immediately available to the Section official, it may be necessary to acquaint the author with the address to which he should send his material when it is finally prepared.

In cases where the material is extemporaneous (panel discussions, question-and-answer periods, open forum, etc) it is the responsibility of the Section to provide for stenotype service, so that a complete record may be available.

PRESENTATION OF A PAPER BEFORE A LOCAL SECTION DOES NOT GUARANTEE PUBLICATION IN THE PROCEEDINGS. AS THE FINAL DECISION RESTS WITH THE AATCC PUBLICATIONS COMMITTEE. However, most papers will be acceptable provided they conform in content and layout to established practices of AATCC.

The National Headquarters Office
of the Association
Will Accept Until Further Notice
PREPAID IN FULL SUBSCRIPTIONS
for
THE SECOND EDITION
of
THE COLOUR INDEX
IN FOUR VOLUMES
published by
The Society of Dyers and Colourists
and
The American Association of Textile Chemists and Colorists
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IN THE TERRITORIES ASSIGNED TO THE ASSOCIATION. SHIPMENTS TO BE MADE VOLUME BY VOLUME AT TIMES CONSISTENT WITH PUBLICATION PROCESSING AND AVAILABILITY.

BEING A LIMITED EDITION THE PROMPT PLACEMENT OF ORDERS THEREFOR IS SUGGESTED. WRITE TO:

American Association of Textile Chemists and Colorists
Box 28, Lowell, Massachusetts

EXAMPLE OF ENTRY IN PART I

C.I. 69025 Anthraquinone **C.I. Vat Orange 1**

APPLICATION

DYEING

METHOD

A/Q1 ☐
A/Q2 ■
A/Q3 ◘
Indigoid ☐

LEUCO COMPOUND
Alkaline, orange brown
Acid, brownish yellow

Vat in short liquor

PROPERTIES (COTTON) Affinity and levelling, good. For data on strike, levelling and migration see *JSDC*, **66** (1950), 505

Suitable for pigment pad-jig, pad-steam, continuous piece and vat-acid processes

Cotton Affinity and levelling good. Dead cotton covered fairly well

Viscose Good affinity at low temperature; at high temperature the hue is redder and duller

Cotton/Viscose Good solidity when dyed cold. At 50°C viscose dyed heavier than cotton

Silk Suitable

PRINTING

Cellulose Applied by normal processes giving redder and duller hues than when dyed. Dischargeable in pale and medium shades in the presence of an assistant

FASTNESS PROPERTIES etc

	A	B	C
CROSS DYEING (Chrome)	..	5	5
HOT PRESSING ...	5	5	5
HYPOCHLORITE ...	5	5	5
LIGHT ¼–½ Normal	5–6	6	6
Normal	6–7	6–7	6
2× Normal	..	7	6–7

	A	B	C
MERCERISING ...	5	5	5
PEROXIDE BLEACHING	5	5	5
SODA BOIL (open kier)	4–5	5	5
SODA BOIL followed by HYPOCHLORITE ... (Combined test)	4–5	4–5	..

Tendering on exposure to light not accelerated

FASTNESS ON SILK (B) Degumming 5, Hot pressing 5, Light 6–7, Peroxide bleaching 4–5

TEXTILE USAGE

DYEING

Cellulose On account of good level dyeing and all-round fastness as a shading colour where good light fastness is required. Suitable for curtains, hangings and for goods to be bleached, e.g. shirtings and towels

Silk For good fastness to degumming, peroxide bleaching and washing

Unions For cotton/viscose fabrics

PRINTING

Cellulose For direct print styles or as pigment with binder on cotton and viscose

HUE **Yellowish Orange**

ARTIFICIAL LIGHT: redder

Benzadone Gold Orange 3G	**YDC**
Caledon Gold Orange 3G	**ICI**
Carbanthrene Golden Orange 3G ...	**NAC**
Cibanone Golden Orange 3G	**Ciba**
Cibanone Golden Orange 3G℗ ...	**Ciba**
Fenanthren Golden Orange 3G ...	**G**
Indanthren Golden Orange 3G ...	**FBy**
Indanthrene Golden Orange 3GA ...	**G**
Indanthrene Golden Orange 3GF ...	**G**
Indanthrene Golden Orange 3GWP ...	**G**
Ponsol Golden Orange 3G	**DuP**
Ponsol Golden Orange 3GD	**DuP**
Sandothrene Golden Orange N3G ...	**S**
Solanthrene Orange 3J	**Fran**
Tinon Chlorine Golden Orange 3G ...	**Gy**

Reactions on Cellulose

H_2SO_4 conc.— greenish blue

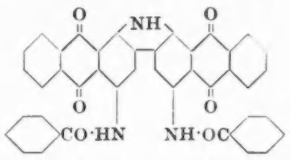
An example from the Vat dyes section of Part I is reproduced above and a specimen page (carbazole vat dyes) from the Anthraquinone section of Part II is shown opposite.

These two examples illustrate the information which appears in Parts I and II and demonstrates the dual reference system which connects the two Parts, e.g.

C.I. Vat Orange 1 in Part I and **C.I. 69025** in Part II are complementary.

The format for the dyes in Part I varies with the amount of information available. Some dyes occupy a whole page, others only part of a page. For example, the space occupied by these notes may be used to accommodate information on **C.I. Vat Orange 2.**

69005 **C.I. Vat Green 9** (*Brownish grey → Dull olive*)



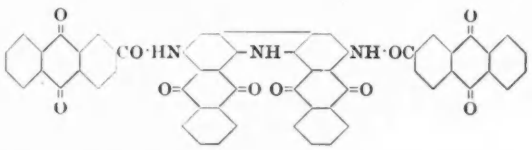
(*a*) Condense 1-benzamido-4-chloroanthraquinone with 1-amino-4-benzamidoanthraquinone in presence of copper and cyclise with chlorosulfonic acid
(*b*) Cyclise 4,4′-dibenzamido-1,1′-dianthrimide in sulfuric acid and oxidise the product

$Na_2S_2O_4$, alkaline — reddish brown; acid — yellowish brown

Discoverer — W. Mieg 1910
Bayer Co., *BP* 2702/09, 11932/09, 25986/09, 29352/10, 15753/12; *USP* 986521, 996109; *FP* 400653, 409407, 432449; *Sw.P* 55556; *GP* 220581, 225232, (*Fr.* **9**, 764, 1197), 228992, 239544, (*Fr.* **10**, 644, 638), 464292 (*Fr.* **16**, 1354)
Brit. Dye. Corp., *BP* 289191
BIOS 1493, 29; *FIAT* 1313, **2**, 135
FIAT 764 — Indanthrenoliv R
Vlies, *JSDC*, **30** (1914), 29
Fierz-David, 584 and Suppl. 82
Houben, 466, 662
Mayer, 181
Fierz-David & Blangey, Table 19
Fraser-Thomson, *JSDC*, **52** (1936), 242
Thorpe, **1**, 422

Soluble in *o*-chlorophenol
Slightly soluble in chloroform, pyridine
Insoluble in acetone, alcohol, toluene, xylene
H_2SO_4 conc. — red; on dilution — flocculent olive green ppt.

69010 **C.I. Vat Green 22** (*Olive*)

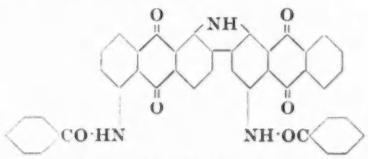


Condense 4,4′-diamino-1,1′-dianthrimide with 2 mol. 2-anthraquinonecarbonyl chloride and cyclise

Discoverer — F. Baumann 1929
I.G., *BP* 349714; *USP* 1819014; *FP* 696423; *GP* 513608 (*Fr.* **17**, 1398)
BIOS 1493, 28
FIAT 764 — Indanthrenoliv 3G

H_2SO_4 conc. — yellowish brown
$Na_2S_2O_4$, alkaline — reddish brown; acid — brownish yellow

69015 **C.I. Vat Brown 5** (*Brown*)



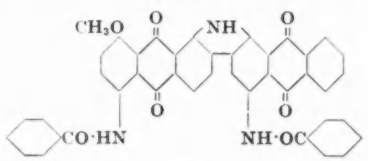
Condense 1-benzamido-5-chloroanthraquinone with 1-amino-4-benzamidoanthraquinone in presence of copper and cyclise with sulfuric acid

$Na_2S_2O_4$, alkaline — reddish brown; acid — yellowish brown

Discoverer — W. Mieg 1910
Bayer Co., *BP* 2702/09, 11932/09, 25986/09, 29138/09, 29352/10, 15753/12; *FP* 400653, 432449; *GP* 220581, 225232, (*Fr.* **9**, 764, 1197), 228992, 239544, (*Fr.* **10**, 644, 638), 491428 (*Fr.* **16**, 1349)
Brit. Dye. Corp., *BP* 289191
BIOS 1493, 10, 12; *FIAT* 1313, **2**, 106
FIAT 764 — Indanthrenbraun R, FFR
Fierz-David, 576 and Suppl. 82
Mayer, 181
Fraser-Thomson, *JSDC*, **52** (1936), 243
Thorpe, **1**, 422

Slightly soluble in xylene
H_2SO_4 conc. — dull wine red; on dilution — reddish brown flocculent ppt.

69020 **C.I. Vat Brown 36** (*Reddish brown*)

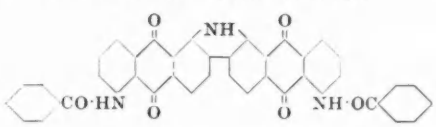


(*a*) Condense 1-amino-4-benzamidoanthraquinone with 1-benzamido-5-chloro-4-methoxyanthraquinone and cyclise
(*b*) Condense 1-amino-4-benzamidoanthraquinone with 1-benzamido-5-chloro-4-hydroxyanthraquinone, methylate the hydroxy group and cyclise with sulfuric acid

Discoverer — F. Baumann 1926
I.G., *BP* 298696; *USP* 1885172; *GP* 481362 (*Fr.* **16**, 1326)
BIOS 1493, 44
FIAT 764 — Indanthrenrotbraun 5RF
Fox, *JSDC*, **65** (1949), 513

H_2SO_4 conc. — violet; on dilution — red
$Na_2S_2O_4$, alkaline — brown; acid — brown (yellower)

69025 **C.I. Vat Orange 1** (*Yellowish orange*)



(*a*) React 5,5′-dibenzamido-1,1′-dianthrimide with sulfuric acid and oxidise
(*b*) React 1-benzamido-5-chloro-anthraquinone with 1-amino-5-benzamidoanthraquinone in the presence of nitrobenzene and cupric chloride

Discoverer — P. Fischer 1910
Bayer Co., *Sw.P* 115114
Cassella Co., *GP* 239544 (*Fr.* **10**, 638), 249000 (*Fr.* **11**, 621)
BIOS 1493, 15, 77; *FIAT* 1313, **2**, 119
FIAT 764 — Indanthrengoldorange 3G
Fierz-David Suppl. 82
Thorpe, **1**, 423

Slightly soluble in nitrobenzene, tetralin, xylene
Insoluble in alcohol
H_2SO_4 conc. — greenish blue; on dilution — orange
$Na_2S_2O_4$, alkaline — yellowish brown; acid — yellow

CONTENTS

The work has been completely re-designed and brought up-to-date with the co-operation of all the dye manufacturers in Great Britain, America, Western Europe, India and Japan. The 2nd Edition is in three main parts.

PART I

PART I— consists of two volumes each of approximately 1,000 pages. It deals with all commercially homogeneous dyes and pigments in current use (approximately 4–5,000 dye entities and 25,000 commercial names) within groups relating to their main usage, e.g. Disperse, Acid, Azoic, Direct, Pigment, Solvent etc. The data included comprises the commercial name and manufacturer's initials, methods of application, fastness properties, established usages, reactions on the fibre and literature references relating to application. In the absence of a single accepted international system of fastness assessment it has been necessary, in this Edition, to make provision for the inclusion of data according to one or more of the following—

A— (American) The methods of The American Association of Textile Chemists and Colorists.
B— (British) The methods of The Society of Dyers and Colourists.
C— (Continental) The methods of the Deutsche Echtheitskommission.

An important feature of PART I is the sub-division of each usage group into hue groups— Yellow, Orange, Red, Violet, Blue, Green, Brown and Black. The hue classification has been made by reference to a Hue Indication Chart which has been designed specially for the purpose. A copy of the chart is included with each set of volumes.
Each dye or group of identical dyes carries a PART I serial name and number, e.g. **C.I. Vat Orange 1**, and also a five digit PART II number in those cases where the chemical constitution of the dye is known.

VOLUME 1 Foreword — Preface — Contents of Volumes 1-4 — Introduction to Part I
Acid Dyes (including the premetallised dyes) — Mordant Dyes — Basic Dyes — Disperse Dyes — Natural Dyes and Pigments — Food (Food, Drug and Cosmetic) Dyes

VOLUME 2 Direct Dyes — Sulphur Dyes — Vat Dyes — Ingrain Dyes — Azoic Dyes (sub-divided into Coupling Components, Diazo Components and Azoic Compositions) — Oxidation Bases — Pigments (inorganic and organic) — Solvent Dyes — Fluorescent Brightening Agents — Developers — Reducing Agents

PART II

PART II— is one volume of approximately 700 pages. It contains data relating to chemical constitution, method of preparation, patent and literature references relating to manufacture or constitution, solubilities and reactions in substance for approximately 3,800 dyes and pigments. The 1st Edition recorded 1,316 constitutions, and this very big increase is partly due to the fact that many co-operating dye manufacturers have, for the first time, disclosed the constitution of certain of their dyes. In addition there is the information contained in the reports compiled by Allied Investigating Commissions on the German Dyestuff Industry.

The dyes are arranged in order based on their chemical constitution following broadly the lines of the 1st Edition. A number of refinements have been introduced and there are two new sections, viz— AZOIC (the coupling components and the diazo components for the production of Insoluble Azo dyes on the fibre) and PHTHALOCYANINE.

Each entry carries a five digit reference number. These numbers do not progress in unit steps as provision has been made to allow the insertion of new constitutions in later editions or supplements without having to change the numbers now allocated in the 2nd Edition. Each entry also carries the complementary PART I serial name and number thus providing easy cross reference to the data in PART I. It also contains alphabetical and empirical formula indexes to all the Intermediates relating to individual dye entities.

VOLUME 3 Introduction — Nitroso — Nitro — Azo — Azoic — Stilbene — Ketonimine — Triphenylmethane — Xanthene — Acridine — Quinoline — Methine — Thiazole — Indamine — Indophenol — Azine — Oxazine — Thiazine — Sulphur — Lactone — Aminoketone — Hydroxyketone — Anthraquinone — Indigoid/Thioindigoid — Phthalocyanine — Natural — Oxidation — Inorganic Pigments — Alphabetical index of Intermediates — Empirical formula index of Intermediates

PART III

PART III— is one volume of approximately 400 pages containing the general index to PART I and PART II (see CONTENTS, [iv]). The Commercial Names Index includes the names (in italics) of dyes not in current use, many of which are related to data in PART I and/or PART II.

VOLUME 4 Hue Indication Chart (in pocket) — Dye Manufacturers' Initials (in alphabetical order) and Names — Dye Manufacturers' Names (in alphabetical order) and Initials — Abbreviations used in Parts I and II — Fastness Tests etc — Patents Index — Conversion Tables relating Colour Index 1st Edition to Colour Index 2nd Edition numbers and Schultz Farbstofftabellen (7th Edition) numbers to Colour Index 2nd Edition numbers and to AATCC Prototype numbers — Commercial Names Index — Additions and Corrections

Piedmont

THE Piedmont Section will hold its winter meeting on January 26, 1957 at the Poinsett Hotel, Greenville, SC. Registration will be held in the lobby from 2-6 pm Friday, the 25th, and 9 am to 6 pm, Saturday, the 26th.

The regular research meeting is set for 10 am in the Hotel's Club Room with L B Arnold presiding. This will be followed by the officer's luncheon at noon in the Statesman Room.

The afternoon technical session will begin at 2:30 with W H Hindle of The Chemstrand Corp speaking on "The Chemnyle Story". At 3:15 Joseph Weber, Research Div, Pabst Brewing Co, will discuss "Meaurement of Dextrinizing Enzymatic Activity in Desizing Agents."

A social hour, beginning at 6 pm, will be held in the Club Room prior to dinner in the Main Ballroom. Featured at the banquet will be A H Ward, district agent, cooperative extension work in agriculture and home economics, State of South Carolina, who will speak on "The Pursuit of Happiness".

Southeastern

ER RAVENEL secretary of the Southeastern Section, has announced the following schedule of meetings for 1957:

Feb 22—Pepperell, Ala (Elwood Barbre in charge)

Apr 13—Lindale, Ga (Ralph Champion in charge)

June 6-8—Summer Outing at Radium Springs, Ga (George Caron in charge)

Sept 14—Columbus, Ga (Hazel L Whittle in charge)

Dec 7—Atlanta, Ga (George L Dozier in charge)

Activities of the Local Sections

New York

THE next meeting of the New York Section will be held January 23rd at the Hotel Delmonico, 502 Park Ave, New York, NY, in the form of a luncheon symposium, the theme of which will be "Changing Trends in Military Requirements". Luncheon will be served at 12:30 pm.

Guest speaker at the luncheon will be Brigadier General Victor J MacLaughlin, whose subject will be "The New Look in Military Textile Purchasing and Distribution".

Directly following the luncheon, the symposium with panels and discussion will take place. Topics will include:

"How Atomic Warfare has Changed Army Requirements for Textiles"—S J Kennedy, US Army Quartermaster Corps

"Textile Requirements for the Navy of the Future"—T J Serry, Dept of the Navy, Bureau of Supplies and Accounts

"Changing Trends in Requirements for Parachute Textile Materials"—J H Ross, Functional Textiles Section of the Textiles Branch, Material Laboratory, Directorate of Research, Wright Air Development Center.

One of the service guests will be Col E H Millson, chief, New York Air Force Development Field Office. Other guests from the Army, Navy and Marine Corps have also been invited.

Philadelphia

ANNOUNCEMENT of approval by the membership of a change in name of the Section and the election of officers for 1957 highlighted the December 7th meeting of the Philadelphia Section.

The Section henceforth will be known as the Delaware Valley Section. The change became effective on January 1, 1957.

Donald W Robinson, Para-Chem, Inc, was elected chairman. Other officials are: *Vice Chairman*—William S Sollenberger, American Viscose Corp; *Secretary*—Ernst W Empting, General Dyestuff Co; *Treasurer*—Albert E Stutzke, Globe Dye Works Co. Councilors for 1957 are as follows: Carleton T Anderson, Ciba Co, Inc; William H Bertolet, III, Laurel Soap Mfg Co, Inc; Arthur W Etchells, Hellwig Dyeing Corp; Clarence A Seibert, Scholler Bros; and Richard A Shimp, E I du Pont de Nemours & Co, Inc.

The following were named sectional committeemen: Jack A Adams, Calgon, Inc; Richard C Kopp, Aberfoyle Mfg Co; L Kevin McChesney, Leatex Chemical Co; and Matthew Noonan, Becco Chem Div, FMC.

Hudson-Mohawk

FIFTY-FOUR members were in attendance at the November 30, 1956 meeting of the Hudson-Mohawk Section, held at the Elks Club, Amsterdam, NY.

Lawrence S Thompson, General Aniline & Film Corp, featured speaker of the evening, discussed "New Developments in the Dyeing of Synthetic Fibers".

In addition, films taken at the Section's 1956 Outing at the Antlers Country Club, Amsterdam, NY, were shown.

AATCC Calendar

COUNCIL
Jan 18 (Hotel Statler, New York); Mar 29 (Roanoke, Va); June 7 (New York)

NATIONAL CONVENTIONS
Nov 14-16, 1957 (Hotel Statler, Boston); 1958 (Hotel Conrad Hilton, Chicago); 1959 (Sheraton Park and Shoreham Hotels, Washington, D C); 1960 (Philadelphia, Pa); 1961 (Buffalo, NY)

HUDSON-MOHAWK SECTION
Jan 25 (Jack's Restaurant, Albany, NY); Mar 29 (Johnstown, NY); May 17 (Ladies Nite—Schuyler Meadows, Albany, NY); June 21 (Outing—Antlers Country Club, Amsterdam, NY)

MID-WEST SECTION
February 16 (Hotel Bismarck, Chicago, Ill)

NEW YORK SECTION
Jan 23, Mar 1 (Hotel Delmonico, New York, NY); Apr 26, May 24—ladies nite (Kohler's Swiss Chalet, Rochelle Park, NJ); June (Annual Outing)

NIAGARA FRONTIER SECTION
Mar 15 (Buffalo, NY); Apr 5 (Joint meeting with CATCC at Kitchener, Ont)

PIEDMONT SECTION
Jan 26 (Poinsett Hotel, Greenville, SC); Mar 30 (Hotel Roanoke, Roanoke, Va); June 7-9 (Outing—Mayview Manor, Blowing Rock, NC); Sept 28 (Hotel Barringer, Charlotte, NC)

RHODE ISLAND SECTION
Jan 24 (Johnson's Hummocks Grille, Providence, RI)

SOUTHEASTERN SECTION
Feb 22 (Pepperell, Ala); Apr 13 (Lindale, Ga); June 6-8 (Outing—Radium Springs, Ga); Sept 14 (Columbus, Ga); Dec 7 (Atlanta, Ga)

WESTERN NEW ENGLAND SECTION
Jan 25 (Hartford, Conn, area); Mar 15 (Rapp's Restaurant, Shelton, Conn); May 17 (Ladies Night—Waverly Inn, Cheshire, Conn); June 14 (Outing—Wallingford, Conn); Sept 27 (Rapp's); Nov 1 (Annual meeting—Hartford area); Dec 13 (Rapp's)

News of the Trade

Pad-Dye to Move

Rudolph Rieg, president of the Pad-Dye Corp, has announced the Company will move within the next two months from its present location at 65 Crosby Pl, Paterson, NJ, to larger quarters at 41 Midland Ave, Wallington, NJ.

The new quarters will include larger laboratory and service facilities.

Pad-Dye Corp manufactures water-soluble acetate dyes under the direction of Otto Poltersdorf, research chemist.

New Olin Mathieson Grant to NC State

A research grant of $6,500 has been made to the School of Textiles Raleigh, NC, by the Industrial Chemicals Division of Olin Mathieson Chemical Corporation.

The grant is for the calendar year 1957 and will cover studies pertaining to the bleaching action of sodium chlorite on cellulosic materials.

The research will be carried out by Dr Heinz Hefti under the direction of Prof Henry A Rutherford at the School of Textiles.

New "Everglaze" Licensees

A license to produce "Everglaze" fabrics has been granted to five additional applicants during the past few weeks, bringing to 228 the total number of firms throughout the world who are permitted to produce fabrics under the "Everglaze" trademark.

The most recent licensees are: Riegel Textile Corporation, 260 Madison Ave, New York, NY; Reeves Brothers, Inc, 54 Worth St, New York, NY; Pioneer Valley Finishing Corp, Holyoke, Mass; Fabric Finishing Co, Passaic, N J; and Texstyle Corp, Clifton, NJ.

Under the Joseph Bancroft & Sons Co patents, the "Everglaze" license permits these textile companies to produce a wide range of effects for many natural and synthetic fabrics in the fashion and home furnishings field. The license also includes the right to the world-wide "Everglaze" trademark, which signifies that the fabric has been processed and tested according to standards and processes controlled and prescribed by the Bancroft Company.

Foxboro Adds Seven Branch Offices during 1956

Seven new branches were opened in eastern and southeastern cities during 1956 by The Foxboro Company, Foxboro, Mass, bringing the company's total number of offices to 52.

In the twelve-month period, the following eastern offices were opened and sales engineers assigned: Augusta, Me—J G Bravacos, sales engineer; Richmond, Va—G E Clark, branch manager; and North Tonawanda, NY—J G Dobson, branch manager. In the southeast: Chattanooga, Tenn—W H Rhyne, sales engineer; Pensacola, Fla—R F Sutton, Jr, sales engineer; Tampa, Fla—F J Stevens, Jr, sales engineer; and Memphis, Tenn—D C Rosser, sales engineer.

Commenting on the expansion, H O Ehrisman, general sales manager, pointed to "the pressure for ever-greater production and increased product uniformity" as a major stimulant in the increased demand for instruments.

Explaining further, Mr Ehrisman said, "To meet accelerated production quotas, processors are converting from older batch methods to the continuous processes which are substantially more dependent on instruments for efficient operation. The instrument-supervised process is not only capable of increased production, but production of greater uniformity, as well as higher quality. Savings often permit write-off of the instrument investment in months, or even weeks."

USDA Advisory Group Makes Recommendation for Home Economics Research

The need for basic research and for developing research tools as well as practical information to improve work in the field of home economics was stressed by the US Department of Agriculture's Home Economics Research Advisory Committee at its meeting in Washington, DC, December 3-5.

Committee members elected as their new chairman Dorothy Siegert Lyle, director of consumer relations, National Institute of Drycleaning, Silver Spring, Md. Named as vice-chairman was this year's chairman, Catherine J Personius, assistant director, New York State Agricultural Experiment Station, Cornell University, Ithaca, NY.

Research proposals for work in home economics in four categories were considered by the committee. Among the recommendations given high priority in the textile and clothing category were the following: Initiate research essential to the improved sizing of shoes and on factors essential to the serviceability of shoes, with emphasis on children's shoes; begin studies to develop functional clothes for pre-school children; widen work to develop improved methods for determining serviceability of various fabrics.

The Committee will submit a detailed report of its recommendations to the Department. Copies of this report may be obtained in a few weeks from the committee's executive secretary, Robert E Stevenson, Office of the Administrator, Agricultural Research Research service, USDA, Washington 25, DC.

Three New Textiles Resins Developed by Cyanamid in '56

The Textile Resin Department of American Cyanamid Co developed three new resins since November, 1955—Aerotex* Resin EU, Aerotex* Resin 390, and Lanaset(R) Resin MW.

Aerotex Resin EU is said to be an exceptionally stable ethylene urea-formaldehyde condensate in liquid form, providing a finish with excellent wrinkle recovery, fabric stabilization, and resistance to damage due to chlorine bleaching on cottons and other types of fabrics. It is also recommended by Cyanamid for durable "minimum care" finishes and for durable mechanical effects, especially schreinering.

Aerotex Resin 390 is a cationic melamine-formaldehyde condensate developed as an anchoring agent for coatings on fibers and fabrics including natural, regenerated or synthetic types. Precoats of Aerotex Resin 390 will increase the adhesion and durability of subsequent coatings which would otherwise show less adhesion to the fabric, it is claimed.

Lanaset Resin MW is a melamine-formaldehyde condensate applied to wool or wool-blended fabrics to reduce wool shrinkage and felting while maintaining a soft hand. It can also be applied as an acid colloid without requiring curing at high temperatures.

* Trade-mark
(R) Registered trade-mark

Eastman Introduced Record Number of New Dyes During 1956

Eastman Chemical Products, Inc, subsidiary of Eastman Kodak Co, Kingsport, Tenn, developed and announced more new dyes during 1956 than during any previous year.

The following dyes were introduced since November, 1955. (Product descriptions are those of the manufacturer).

Eastone Fast Pink B-GLF——This outstanding dye produces soft shades of pink on acetate fabrics of unusual all-around fastness including excellent resistance to light, atmospheric fumes, washing, perspiration, urea-formaldehyde resins and sublimation. Suitable for piece-dyeing and printing.

Eastman Fast Yellow W-GLF——Producing bright yellow shades on acetate fabrics, Eastman Fast Yellow W-GLF possesses excellent fastness to gas, light and washing. Suitable for piece-dyeing and printing.

Eastone Fast Scarlet R-GLF produces bright scarlet shades on acetate fabrics with exceptional fastness to atmospheric gas fading, light, sublimation, crocking, perspiration, washing and crease-resistant resins. Suitable for piece-dyeing and printing.

Eastone Blue 5G-GFD——A bright, blue-green acetate dye with excellent dischargeability and outstanding gas fastness, Eastone Blue 5G-GFD undergoes very little shade change under artificial light. In addition to its usefulness as a self-color, Eastone Blue 5G-GFD, in combination with other colors, enables dyers to obtain a greenness under artificial light. Suitable for piece-dyeing and printing.

Eastone Blue 3G-GFD——Similar in properties to Eastone Blue 5G-GFD, but slightly less green in shade. Suitable for piece-dyeing and printing.

Eastman Diazo Navy Blue 2R——A particularly important dye for use in obtaining bright, wash- and light-fast navy shades and black on combination fabrics of acetate and viscose by virtue of its ability to reserve viscose even in high dyeing concentrations. Eastman Diazo Navy Blue 2R is particularly easy to handle in the production of navy shades since the introduction of additional small quantities to the dyebath does not result in a sudden change to black.

Eastman Polyester Yellow W dyes polyester fibers a bright greenish yellow with excellent fastness to light, washing, dry cleaning and sublimation. It can be applied at the boil with a carrier, or under pressure without a carrier.

Eastman Polyester Yellow 5R is a good low-cost yellow with excellent tinctorial value for dark brown and green shades. The fastness to light, washing, dry cleaning and solvent spotting is excellent. On very heavy shades a slight sublimation may be noted.

Eastman Polyester Red B dyed on polyester fibers with chlorinated hydrocarbon carriers or under pressure has excellent fastness to sublimation, light, washing, wet pressing and dry cleaning. The phenyl phenols affect the light fastness, but a heat treatment after dyeing will restore the light fastness.

Eastman Polyester Red 2G is a bright yellowish red with excellent fastness to light, washing, dry cleaning and sublimation. It may be applied with a carrier at the boil, or under pressure without a carrier. The phenyl phenols affect the light fastness, but a heat treatment after dyeing will restore the light fastness.

Eastman Polyester Blue GR dyed on polyester fibers has excellent fastness to light, washing, sublimation, dry cleaning and wet pressing. It has been used particularly for dyeing the polyester content of wool-polyester combination fabrics. Eastman Polyester Blue GR has less affinity for cellulose acetate fibers.

Eastman Polyester Blue GLF has been used extensively to dye polyester fibers in tow, tops, stock or fabric form with excellent fastness to light, washing, dry cleaning, sublimation and wet pressing, particularly in light shades.

Eastman Polyester Blue 3RL is a bright, red shade of blue with excellent fastness to sublimation, washing, light, dry cleaning, and wet pressing, and does not flare red under artificial light. It is an excellent low-cost blue component for dark shades such as navies, blacks, dark browns, and may be dyed in tops, tow, stock or fabric form. Eastman Polyester Blue 3RL may be dyed with carriers or under pressure.

Eastman Polyester Navy G is used to obtain less expensive navies, dark browns, blacks and other dark shades. It has excellent fastness to sublimation, dry cleaning, light, washing and wet pressing. Eastman Polyester Navy G may be dyed with carriers or under pressure.

Eastman Polyester Black RB is a diazo type of black which gives, on development, full shades of black fast to light and washing.

General Calendar

AMERICAN OIL CHEMISTS SOCIETY
Spring, 1957 (Spring meeting, New Orleans); Sept 30-Oct 2, 1957 (Fall meeting, Cincinnati); Apr 21-23, 1958 (Memphis); Oct 20-22, 1958 (Chicago); Spring, 1959 (New Orleans); Fall, 1959 (Los Angeles).

AMERICAN MATERIAL HANDLING SOCIETY
Apr 29-May 3 (7th Materials Handling Exposition, Convention Hall, Philadelphia, Pa)

AMERICAN SOCIETY FOR QUALITY CONTROL
Feb 25-27—7th Annual Conference of the Textile Division, Georgia Tech, Atlanta, Ga.

THE DRYSALTERS CLUB OF NEW ENGLAND
Jan 21 (Hotel Somerset, Boston); Apr 26 (Hotel Vendome, Boston); June 21 (Annual Outing—Wachusett Country Club, West Boylston, Mass).

THE FIBER SOCIETY
Spring Meeting—May 1-2, 1957, The Clemson House, Clemson S C; Sept 4-6 (Joint meeting with the Textile Institute—Hotel Statler, Boston, Mass)

NATIONAL ASSOCIATION OF HOSIERY MANUFACTURERS
NATIONAL KNITTED OUTERWEAR ASSOCIATION
UNDERWEAR INSTITUTE
April 29-May 3 (1957 Knitting Arts Exhibition, Atlantic City, NJ)

NATIONAL COTTON COUNCIL OF AMERICA
Feb 28-Mar 1 (Cotton Research Clinic, General Oglethorpe Hotel, Savannah, Ga). October 2-3 (Chemical Finishing Conference—Statler Hotel, Washington, DC)

PHI PSI FRATERNITY
April 25-27—Annual meeting, New Bedford Hotel, New Bedford, Mass.

PHILADELPHIA TEXTILE INSTITUTE ALUMNI ASSOCIATION
March 1 (56th Annual Banquet, Bellevue-Stratford Hotel, Philadelphia, Pa)

PURDUE UNIVERSITY
May 13-15 (12th Purdue Industrial Waste Conference, Purdue Univ, Lafayette, Ind)

SCALAMANDRE MUSEUM OF TEXTILES
Jan-Mar, 1957 (Exhibit—"Two Hundred Years of Textile Designs"

TEXTILE QUALITY CONTROL ASSOCIATION
March 28-29 (Spring Meeting, Clemson House, Clemson, SC)

• NAMES IN THE NEWS •

The retirement of **Harold F Merritt**, vice president of Solvay Process Division, Allied Chemical & Dye Corporation, became effective December 31, 1956. At the same time appointment of **Lester B Gordon**, a Solvay vice president, as head of the Solvay sales organization, was announced.

Mr Merritt's entire business career of over 43 years has been spent with Solvay. He first joined the organization in 1913 after obtaining his Chemical Engineering degree at New York University. He has been vice president of sales for Solvay since 1931.

Mr Gordon will continue to make his headquarters at Solvay's executive office located at 61 Broadway, New York.

J Lee Marsh has been appointed vice-president—development of Carbide and Carbon Chemicals Co, a Division of Union Carbide and Carbon Corp. Dr Marsh will be responsible for the Development Department of the Chemicals Company as well as for all phases of its textile fibers activities.

Dr Marsh has served as director of engineering at South Charleston, W Va, since 1952.

Two reassignments of technical representatives have been made in Carbide and Carbon's Sales Department. The new assignments are: **W P Emerson** from office to field sales in the Atlanta District, and **M H Mackay** from the Chicago District to the Newark District.

Fred C Foy, president, Koppers Co, Inc, has been elected to the board of directors of H K Porter Co, Inc. Mr Foy joined Koppers in 1948, became a director in 1954 and was elected president in 1955. Before joining Koppers he was vice president and manager of the Detroit Office of J Walter Thompson Co.

Billy R Coggins has been awarded the Owens-Corning Fiberglas Corporation Scholarship in the School of Textiles at North Carolina State College.

The scholarship award will cover two years of study and is valued at $500 per year plus all tuition and fees.

It is one of the most valuable scholarships at State College and is awarded on the basis of ability, scholastic achievement, leadership potential, and need.

Louis I Weiner of the QM R&D Center, Natick, Mass, receives special award from Col John D Martz, Jr, deputy commander. A W Harvey, director for development, is at left.

The Quartermaster Research and Development Command announced last month that a special award was recently presented to one of its textile and fiber specialists, **Louis I Weiner**, of the Textile, Clothing and Footwear Division. The citation reads:

"For his consistently effective leadership in the Textile Engineering Laboratory, the Quartermaster Research & Development Command commends Louis I Weiner. His technical direction of the laboratory program, which concerns itself with fundamental and applied research studies dealing with the physics, mechanics and engineering of fibrous substances has been an outstanding example of modern research and development management.

"His study projects concerned with the investigation of test methodology and a program encompassing studies in the field of fabric engineering and fabric properties have brought great credit upon this Command and the Quartermaster Corps."

In the temporary absence of **Brigadier General C G Calloway**, commanding general of the QM R&D Command during the award ceremony, the citation scroll was presented to Mr Weiner by the deputy commander, **Col John D Martz, Jr.**

Ben H Kirby, formerly with General Aniline & Film Corp and the Pittsburgh Coke & Chemical Co, has joined American Aniline Products, Inc, a wholly-owned subsidiary of Koppers Company, Inc, as assistant to the director of operations.

Dr Kirby will assist in all new developments at the company's Lock Haven, Pa, operations.

Eugene J Sullivan has become vice president in charge of sales for the Borden Company's Chemical Division.

Formerly general manager of the Resins and Chemicals and the Polyco-Monomer Departments, he started with the Division ten years ago as a salesman of packaging adhesives.

Stirling Turner has been promoted to the newly created post of assistant to the plant manager of the Chemstrand Corporation nylon plant at Pensacola, Fla.

Turner's duties will also include some public relations activities.

Since joining Chemstrand in 1953, Turner has been purchasing supervisor at the Pensacola plant.

Organic Chemicals Division of the American Cyanamid Company has announced that twelve new employees have recently joined the Division's technical organization in Bound Brook, NJ.

Robert G Scott and **George M Knobl** have been named development chemists in the Division's dyes department while **Frank J Arten** and **Peter V Susi** have been named as new development chemists in the chemicals department.

John C Ryan, Daniel H Gold, Stanley Mitzner, and **Joseph J Garbarino** have been named a new development chemists in the analytical department.

Leonard B Hallows has joined the division as a chemist in the textile resins sales laboratory; **Arthur A Doering, Jr.** as a research chemist in the process development department.

Andrew T Cole will serve the division as a research chemist in the dyes department. **James Hazelton** is a new process engineer in the intermediate department.

Emery Industries, Inc, Cincinnati, O, has named **Albert F Stahl** and **Robert Knippling** to the Process Research Section and **John V Killheffer, Jr** to the research staff.

Messrs Stahl and Knippling will be associated with the Production Group under the direction of **K T Zilch**, where they will conduct research on both new and existing methods for producing fatty acids and their derivatives.

Prior to joining Emery, Mr Stahl was a project engineer with Becco Chemical Division of Food Machinery and Chemical Corporation.

Mr Knippling for the past 4 years has served in Emery's Control Laboratory.

Mr Killheffer will be associated with the Plasticizer Group of the Process Research Section under the supervision of **C A Sprang**, where he will work on both new and current plasticizers of Emery's extensive line. Prior to joining Emery, Mr Killheffer was a chemist with the Organic Chemicals Department of E I du Pont de Nemours & Co, Inc.

Apex Chemical Co, Inc, Elizabethport, N J, has appointed **Archie Chevrette** as its new technical representative in the New England area.

Mr Chevrette has spent over 40 years as a dyer and finisher, including 20 years with Thomas Dalby Inc, Watertown, Mass, and most recently with Brown-Century Corp and Swan Knit Inc.

Oliver B Beckwith has been appointed quality control director of The William Carter Company, manufacturers of knit underwear.

Mr Beckwith will work from the Needham Heights, Mass, home offices of the company. Before coming to Carter's, he was with the Fabric Research Laboratories, Inc, Dedham, Mass, as senior research associate in charge of quality control.

The appointment of **George R Lawson** as director of marketing has been announced by Pennsalt Chemicals' Industrial Division. In this newly created position, Mr Lawson will direct the combined sales organizations of the former Sharples and Industrial Chemicals Divisions, which were recently consolidated in the formation of the Company's new Industrial Division.

Mr Lawson joined the Pennsalt organization in 1946 and served most recently in the former Sharples Division as vice president in charge of sales.

Williams

Edward J Willims has been named financial assistant to **Philip M Dinkins**, vice president of General Aniline & Film Corp and general manager of the Company's Dyestuff and Chemical Division.

Mr Williams, a certified public accountant, was formerly with the Magic Chef Corp, St Louis, Mo, where, until joining General Aniline, he had been controller.

William C Menzies, Jr, has been appointed to the post of technical director of the Lowell Technological Institute Research Foundation. He will succeed **George O Langlais** who has accepted a position in technical services with Monsanto Chemical Co in Springfield.

Mr Menzies was formerly assistant head of the processing and weaving department of the pilot laboratory at Celanese Corp of America, Charlotte, N C.

William R Bates has been appointed manager of the Chicago chemical branch of McKesson & Robbins' chemical department with headquarters at 540 West Randolph Street, Chicago.

Mr Bates has been with the McKesson organization since 1951, beginning as a salesman for the Chicago chemical branch, and later serving as manager of the Milwaukee branch.

Obituary

CHARLES L HOWARTH

Associate Professor Charles L Howarth, for 35 years a member of the chemistry department at Lowell Technological Institute, died after a short illness December 31, 1956.

He graduated from LTI in 1917 with the bachelor of textile chemistry degree. After industrial experience with the Middlesex Bleach, Dye and Print Works in Somerville, Mass, and Sayles Finishing Plants in Saylesville, RI, he was appointed to the LTI faculty in 1921. During World War I he had charge of the testing laboratories at the Boston Depot Army Quartermaster Corps.

He held membership in the AATCC and served as consultant for Dow Chemical Co, Carbide and Carbon Chemicals Co, and Kelco Co.

Lyman Billings has resigned as technical service director of the Fiber Division, Virginia Carolina Chemical Corp to accept a position with the Merrimac Paper Co, Lawrence, Mass.

Hooker Electrochemial Co, Niagara Falls, NY, has announced new appointments among executive and administrative personnel of the former Oldbury Electro-Chemical Co, now the Oldbury Division, Hooker Electrochemical Co since its consolidation into Hooker on Nov 30.

Earl L Whitford, now vice president and director of Hooker, and formerly president of Oldbury Electro-Chemical Co, will coordinate the Hooker research programs at Niagara Falls, including the Oldbury Division, as well as the Durez Plastics Division at North Tonawanda and LeRoy, NY. Reporting to Dr Whitford will be **Johannes H Bruun**, director of research and development; **Walter H Prahl**, director of research and development, Durez Plastics Division; and **James H Brown**, manager of research and development, Oldbury Division.

Other employees named to new positions in the Oldbury Division at Niagara Falls are: **Marion B Geiger**, general manager, reporting to **Thomas E Moffitt**, executive vice president of Hooker; **Clarence A Stiegman**, technical director; **Maynard L Parker**, production manager; **John C Pernert**, chief research chemist; **Harold L Townend**, chief engineer; **William H Streicher**, plant engineer; **Floyd E MacDonald**, personnel director. **Harry R Oswald** has been named works manager of the Columbus, Miss, plant.

Sales department appointments for this division are as follows: **Harold N Fyffe**, general sales manager; **Robert B Boyd**, sales manager; and **Fred H Berggren**, assistant sales manager. This group will report to **Robert E Wilkin**, Hooker vice president and director of sales.

Clemson College has announced 1956-57 recipients of textile school scholarships from Ciba Co, Inc, New York, NY, and Seydel-Woolley and Co, Atlanta, Ga.

The $500 Ciba scholarship goes to **Donald Logue**, a native of Wilmington, Del, who now lives in Clemson, and is majoring in textile chemistry as a junior.

Winner of the Seydel-Woolley award, a $250 scholarship, is **Richard McClelland**, a textile engineering senior from Spartanburg.

The Ciba scholarship is given annually to a junior in textile chemistry; the Seydel-Woolley scholarship to a junior or senior in textile chemistry or textile engineering.